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THE HERBERT SPENCER LECTURE

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HERBERT SPENCER

The circumstances under which I am invited to address this University bear emphatic witness to the profound and world-wide influence of Herbert Spencer. A Hindoo gentleman, once responsible for the government of a native Indian state, and a Master of Arts of Balliol College, has endowed a Lectureship in the name of our English philosopher. The University, in the broad spirit of its culture that Spencer himself so curiously misunderstood, has accepted this commemoration of the founder of a System, which, to say the least, ignored both its immemorial theology and its ancient learning. And now, by the choice of the founder of this Lectureship and of the Academic authorities, one is called to open this Course whose only claim to philosophy is that for thirty years he has sought to explain and to propagate the system of a French philosopher to whom Spencer declared himself opposed on many points. He certainly coincided with him on many others. These points were quite as essential, and some differences also may be reconciled in the end. Philosophy, to be worthy of its name, must ever embrace and reconcile fundamental differences of view.

It will not be supposed that I come here to revive any former controversies or to start any new. For forty years I enjoyed the friendship and valued the advice of Mr. Spencer. For many years I was in close touch with him and with his most intimate

associates, so that I had ample opportunity of becoming familiar with the inner story of his long intellectual martyrdom to his high purpose. In public and in private I have never ceased to express all the admiration I felt for his grand intelligence, for his tenacious devotion to duty, and his truly marvellous perseverance. At his death I expressed my deep sense that our country had lost its most eminent philosopher. And I shall not depart from that spirit of grateful reverence.

But, again, this is no occasion for an apodictic eulogy. I come here to speak of a system of philosophy—not to praise a man in words of idle rhetoric. As this is the first of these Lectures, as I was myself in touch so long and so closely with Herbert Spencer the man, and not simply the author of books, it will be right for me to begin with some personal reminiscences. I shall then seek to call attention to the permanent significance of the Synthetic Philosophy, without pretending to conceal what I hold to be its aspects of weakness and narrowness, but without venturing to insist on or to develop these points of difference. And finally, I shall ask your indulgence if I try to sketch in slight outline those conditions of logic, of science, of human psychology, which must be fulfilled by any scheme of *Synthesis* worthy of that great name, apart from the special doctrines whether of Spencer or of Comte.

I use true but guarded words if I venture to say that, in the judgement of foreign as well as of English thought, Herbert Spencer was the most prominent English philosopher of the nineteenth century. I do not say the greatest man of science, or the subtlest metaphysician, or the most creative genius, but the philosopher whose ideas have had the widest range,

and have commanded at home and abroad the most penetrating power. This judgement rests on the fact of the very rare band of those who can be called philosophers, and of the infinite difficulty of the task of constructing anything that can be treated as a Synthesis of human knowledge. In a world saturated with departmental research and with specialist learning, the effect of a synthetic co-ordination of ideas forces the attention and stirs the imagination of all serious students, whether they accept or reject the special conclusions of the system.

In any case, all can do justice to a noble life of devotion to social duty and a grand ideal. The story of Spencer's life has been one of almost unexampled absorption in the vast task to which he dedicated himself from youth. The record of British philosophy can hardly furnish an instance of perseverance in labour so continuous, so protracted, so beset with difficulties and obstacles of all kinds—scanty means, desultory training, oppressive neglect, bodily suffering—in a career wherein profit, honour, and success were hardly to be expected, or came so late as to be little valued. For more than forty years he laboured to build up his encyclopaedic system step by step, without for an hour swerving from his aim, or sacrificing one of his rigid rules of life. Personal tastes could not draw him, nor could obstacles deter him, from his goal. Enjoying the society of cultivated men and women, as he did, and forced to accept involuntary leisure from the state of his health, he yet habitually shunned every social distraction. No prospect of gain, no hope of rest, no fear of destitution, no prostration by disease, ever tempted him, or ever drove him from his allotted task. No man ever

more entirely fulfilled the maxim of the French poet, which another philosopher took for his favourite device: '*What is it that makes a great life? It is the ideal of youth carried out in mature age.*' It is thus that, almost alone of modern philosophers, Herbert Spencer achieved all that he purposed, and perhaps all that he was capable of completing.

This abnormal power of philosophic detachment from the vulgar interests and pursuits of ordinary life enabled Spencer to achieve his end in spite of the unremitting pressure of physical ailments. It would be difficult to find another example of vast intellectual performance carried through against incessant recurrence of prostrating ill-health. The posthumous *Autobiography*, with its diaries, letters, and memoranda, reveals what, even to his intimate friends was not fully known, the degree to which the philosopher was perpetually incapacitated from all mental work. His physique was good and his health sufficient in early life. But at thirty-five he suffered from a break-down which left him a permanent invalid, so far as continuous mental attention was concerned. Dyspepsia, insomnia, nervous irritability dogged him for the rest of his life. His labour was continually interrupted for weeks and even for months together. At no period after middle life was he ever capable of more than three hours of reading or dictation in each day. The effort of composition was seldom continued for more than half an hour, or even ten minutes, without a pause to rest. After a few hours of work he was unable, during the rest of the day, even to read a novel or to engage in general conversation. The slightest mental effort, or the most ordinary excitement, brought on that cerebral congestion which cut him off from

books, from society, from sleep, and even artistic amusement. Fishing, sailing, and strolling along the seaside were the only solace of these cerebral disorders. The extraordinarily scanty time which Spencer could give to reading, to composition, or even to meditation, and yet the achievement of so vast a result—this remains a problem for psychologists and biologists to solve. Professor Huxley told me that he had never met a man who had so great a power to pick the brain of a competent student. For many years Spencer lived in close intellectual commerce with men of special authority in all the natural sciences. In these days when we hear so much of exhausting study and over-pressure, it is well to remind young students what achievements are possible to the Darwins, the Carlyles, and the Spencers, by the intense concentration of their brain-power, rather than by the long hours they spend at their desk.

Spencer stands forth amid all our English philosophers since Bacon, as having deliberately set to himself, for the task of his life, the framing a *Synthesis* of Knowledge—a Science of the Sciences—a System whereby all human ideas, scientific, moral and social, could be harmonized in one dominant concatenation or correlation. To Spencer, *Synthesis* meant a real organization of the sciences, the binding up of all special learning into an organic unity—vitalized in every cell of the encyclopaedic mass by creative and omnipresent ideas, themselves inspired and controlled by one governing conception. In this ideal Spencer (amongst us) stood alone. The *Synthetic Philosophy* is (in Britain) unique. No British philosopher, unless it were Roger or Francis Bacon, has conceived, or even adumbrated, anything of the kind. And we know how rudimentary were the

sciences in the time of either Bacon, how hopeless a dream it was for either to presume to organize general science. Utterly unlike Francis Bacon as was Spencer, in character, in life, and in brain, even the antithesis of Francis Bacon in many things, the critics both at home and abroad have constantly compared them and contrasted them, by reason of the encyclopaedic nature of their studies and the synthetic power of their genius. And for this there is a certain warrant in fact. That of which Francis Bacon dreamed with his luminous imagination Spencer planned out with a far sounder scientific basis and a less utopian ambition. Spencer thereby remains our one synthetic philosopher. Whether that Synthesis has yet been, or is ever destined to be, accepted as adequate is a problem which we may presently consider. But its rare power to rivet the attention of the thinking world, and to plant the seeds of an infinite crop of fertile conceptions, can hardly be gainsaid by any serious student of the evolution of modern thought.

Whether one can rest satisfied with such a symmetrical solution of the mysteries of the Universe, whether any Synthesis of the Universe as a whole be a practicable problem, to be solved as yet, or indeed at any future time, we can all do justice to the magnificent vision of a coherent Synthesis, a system combining physical and sociologic knowledge in one scheme. And we all bow down to the heroic courage with which Herbert Spencer put aside pleasures and rewards in the long strain after his supreme idea. The literary and scientific world in Europe, in America, and in the Far East does homage to this devotion to the ideal of a Synthetic Philosophy. To many it comes like the dawn of a new era, in an age absorbed in the infinite analyses of fissiparous specialism.

It seems to offer a possible clue to the mighty labyrinth within which we still wander almost without hope.

The men who succeed in organizing any scheme of general thought, in such a way as to command the attention of all those in the civilized world who devote themselves to philosophy and to science, are so infinitely few—the resources needed even to attempt such a task are so complex and so rare—their labours are so precious to the advancement of human thought, that we judge their work to be worthy of study and honour, even if we find manifest errors in certain parts, and they fail to satisfy their generation. Consider the sophisms now acknowledged to ruin some of the most famous philosophies of the past. Remember how small after all is the residuum of permanent truth accepted as the contribution to human thought of the most illustrious thinkers of old. For some two thousand years the noble utopia of Plato has been an armoury of pregnant ideas to the religious and speculative conceptions of the entire West. We can smile at his exquisite fantasies and his airy hypotheses—yet we ponder him with delight, and refashion his gorgeous cloudland again and again—*amicus Plato sed magis amica veritas.* On what wings of unstable wax did the two Bacons essay to rise into the empyrean and face the Sun of truth! How puerile seem to us now Descartes' *vortices* and not a little in Hume's arid dogmatism and in Hegel's paradoxical transcendentalism with its identity of contradictories. And withal, how great and how just is the reputation of these men!

The truly general syntheses are so extraordinarily few in the history of the human mind, they lead to such wide and unexpected results when they stir the interest of the philosophic world, that any substantial

synthesis lives and moulds opinion, even when its details are rejected and its conclusions are ignored. To put aside the ancients, Aristotle, Plato, and their derivative schools; to put aside the mediaeval logicians, Albert, Roger Bacon, Aquinas, all of whom constructed provisional and indeed illusory syntheses of a kind, under the dominant theology and metaphysics; to come to the moderns, we can only name with assurance Descartes, Leibnitz, Kant, and Hegel. Neither Francis Bacon, nor Hobbes, nor Locke, nor Hume, nor Diderot, nor Montesquieu, nor Bentham, Mill, or Hamilton, attempted what a true Synthesis demands—a general co-ordination of all the sciences, a harmony of the moral and the physical worlds as we know them. Nor, in our own generation, can I count more than two such schemes of general knowledge—the Positive Philosophy of Auguste Comte, and the Evolutionary Philosophy of Herbert Spencer. It is no paradox that, in philosophy, a systematic co-ordination of ideas may ultimately be judged as abortive, and yet may remain one of the landmarks of human thought and a monument of human genius.

Consider the far-reaching and incalculable effects upon all subsequent thought of such fundamental conceptions as those of Bacon's *Organum*, Descartes' *Meditations*, Newton's *Principia*, Hume's *Essays*, Kant's *Kritik*, Darwin's *Origin of Species*. These effects are quite distinct from acceptance of the whole of these conceptions as irrefragable truth. An age which has dedicated its industry to infinitesimal analysis and an almost jealous specialism is too apt to slight the power of the imagination in the service of a great constructive brain. Philosophy, like poetry itself, can do nothing abiding without the synthetic imagination. To limit

the attention to flaws in the details of a symmetrical scheme of ideas is like wasting time over anachronisms in the *Iliad*, or false astronomy in the *Divine Comedy*.

What is the true definition of *Philosophy*—what of *Synthesis*—what of *Evolution*? Philosophy means *ultimate generalization*. Spencer correctly defined it as 'knowledge completely unified.' Our first crude observations are special, local, disparate. Science only begins with the colligation of crude separate observations. Each general science implies the colligation of a large body of departmental generalizations. The generalization of all the general sciences in their ultimate co-ordination is philosophy. Such is Spencer's own account of it; and, no doubt, with modifications in language, such an account of philosophy would be generally, or at least very widely, accepted. Well! it was to the search for such ultimate generalization of all general scientific conceptions that Spencer dedicated his life—a task which so very few in the history of human thought have ever attempted—in which almost no one has succeeded.

Now, as to the meaning of *Synthesis*—an indispensable word which is needed not only for philosophy but for all serious thought. Synthesis—the converse of analysis—is the co-ordination of general conclusions. All real philosophy, no doubt, is synthetic—a term introduced long ago by Comte, which Comte and Spencer incessantly employ. By a 'Synthetic System of Philosophy' Spencer seems to have understood a system which propounded a harmony of all the known sciences, as distinct from any system of transcendental Ontology. In that sense the 'Synthetic System' of Spencer and the 'Positive Philosophy' of Comte mean entirely the same thing. Both mean the ultimate

generalization of the whole field of real knowledge, the co-ordination of all positive science. Theology, Ontology, Cosmogony stand outside both systems—in the void and formless infinite of the Unknown.

Let us turn to define *Evolution*—a word about which much ambiguity exists. In its narrower sense 'Evolution,' a term not at first used by Darwin, means the morphological and physiological variations of organic beings by the action of natural selection. It then came to be loosely applied to almost any specific theory about the origin and development of things. At one time to doubt such a dogmatic genesis was to risk being charged as an unbeliever in Darwin's great theory of animal transformation. I used to think that Professor Huxley looked on 'Evolution' as the *nom de guerre* of the Royal Society, or perhaps even of its most eloquent Fellow. But 'Evolution' in the hands of Herbert Spencer meant something quite different: far wider in scope and more philosophic in spirit. Spencer meant by Evolution a theory of the gradual development of all phenomena, cosmical and physical, human and moral, under a set of dominant and co-ordinate principles. These principles were to form the ultimate generalization of all the Sciences; they had to explain and harmonize them all under a vast clarifying searchlight.

Now Spencer's conception of Evolution, as formulated in his famous propositions, is a Synthesis far wider than any theory of Darwin's, not at all comparable with it, and in general idea even anterior to the theories of Darwin by date of publication. Darwin certainly, and not Spencer, was the originator of the strictly biological law, inductively proved, of the modification of organic beings by natural selection and some other

agencies. Spencer very soon adopted this view, incorporated it in his own system, and to the last maintained important qualifications of it as essential. But, even prior to the publication in 1859 of Darwin's *Origin of Species*, Spencer, from 1852 downwards, had stated his general law of Evolution, using that term which had been common in French philosophy for more than a century, but always falling short of the theory of Natural Selection in the struggle for life.

And then, in 1860, Spencer put forth his encyclopaedic scheme of a general philosophy, based upon the laws of Evolution as applicable to the whole field of human knowledge—cosmical, material, vital, and human. Spencer's conception of Evolution, though it incorporated Darwin's laws as to the mutability of species, is not only utterly different from pure Darwinian Evolution, but is not commensurable with it. We could no more compare them than we can compare Kepler's laws of planetary motion with Bacon's Inductive method. Darwin was a naturalist: Spencer was a philosopher. And no one was more ready than Darwin himself to recognize the difference and the higher rank of the philosopher. Darwin rarely quits the ground of multiple inductions and massive observations of the organic world. Spencer was no specialist. He attempted a general co-ordination of phenomena, cosmical and human, dealing very largely in abstract propositions; using the deductive method even more than the inductive; using logic and hypothesis quite as much as observation. Not only is Spencer's Evolution disparate from Darwin's, but, to the last, Spencer maintained special views as to the Factors of Organic Evolution. He held to the inheritance of modifications that had been functionally produced during active life—

a view which has not obtained the assent of most competent biologists.

I face the inevitable question—Does Philosophy really mean 'a science of the sciences'? Is any harmony or correlation of all human knowledge either possible or needful? Well, if not, then *cadit quaestio*, and Spencer's claim to be a philosopher falls to the ground, whatever his claims to acute thoughts on biology, sociology, and ethic. We well know the energy and ability of the many schools of thought—theological, idealist, and ontological (or it may be sceptical)—which would maintain that the only Philosophy is one that is concerned with the mystery of the Universe and the soul of man; that human science cannot attain to the higher knowledge or to any generalized truth; that each branch of knowledge rests independent by itself, incapable of any ultimate generalization or real co-ordination at all. With such schools the true Spencerian does not dispute. He awaits the verdict of the ages—*securus iudicat orbis terrarum*. By their fruits you shall know them!

If there were indeed a final bar to synthesis, how do we account for the deep reverberation through the civilized world of the name and ideas of Herbert Spencer? That name, those ideas, have permeated East and West, science, philosophy, and literature, wherever culture exists. It is an illuminating influence that may be compared with the influence upon subsequent thought of the ideas of Bacon, of Hume, of Kant. His works have been translated into nearly all European languages. They are read and studied in India, in China, in Japan. In the vast reading public of America they are far more widely known and esteemed than even in our own country. At his death the journals,

the lecture halls, the pulpits of Christendom resounded with accounts of his life and work. In no nation had a deeper impression been made, we are told by an eminent native disciple, than in Japan. The *Sociology* has been translated into Chinese. Churches, Chapels, Synagogues, Ethicists, Secularists and Positivists, hailed Spencer as a leading philosopher of his time. A diligent friend has collected in three folio volumes this immense consensus of tributes in all the languages of Europe. Can it be that all this chorus of admiration and interest was aroused by what was after all (some might say) a pretentious dream, as baseless as the 'Ideas' of Plato and far less poetical? No! It testifies to the insatiable craving of the human mind for some coherent system of thought—the invincible instinct that human science is not a bubble of the imagination, that as science means a generalization of observations, so the sciences in the sum are capable of some ultimate generalization, some co-ordination, some organic relation to each other.

Is then the ultimate generalization of Spencer destined to achieve general, and final, acceptance? It is not for me to presume to answer such a question—all the more that, as I began by saying, I have been trained in a school from which Spencer continually insisted on his own dissent. But there are deep underlying axioms in the Synthetic Philosophy of Spencer which entirely coincide with all types of the Philosophy of Experience, as distinct from all Metaphysical and Intuitional Schools of Thought. They run on parallel, if not identical, lines with all types of what may be called Positive systems in the widest sense, so as to include those of Comte, Darwin, Littré, Mill, Buckle, Clifford, Huxley, Bain, and Lewes. These fundamental points are (1) *the universal reign of law* in all branches

of human cognition: that all true knowledge recognizes and rests on some invariable order of phenomena in all things subject to human observation, whether in the material or the moral world. (2) Next comes the *law of constant evolution*, the development of each cognizable state from a preceding state under the operation of regular influences and conditions. (3) Thirdly, the *relativity of knowledge* is a universal axiom; the *absolute* being beyond the bounds of human knowledge, and in its nature truly unthinkable. (4) Fourthly, Philosophy *relegates unverifiable hypotheses* to a world outside positive science. (5) The *Telos of Philosophy* is a constructive reorganization of all human knowledge in a *synthesis*, or correlation of parts. (6) The *Telos of human life* is the practical and continuous *amelioration of* the material, social, and moral conditions of *the Human Organism*—the unity of the Brotherhood of Man on this planet. In all these fundamental bases of thought Spencer's System coincides with all types of *positive* philosophy. They can only be displaced by the final triumph of some form of theological and intuitional belief.

But at this point, I mean with the acceptance of these six principles, and all their many corollaries, Spencer parts company with the other schools of the Philosophy of Experience, certainly with the *positive* school, strictly so called. Spencer takes a new and a wholly different position—a ground where he is entirely independent and unique. So far as I know, Spencer, with those who follow him, stands alone amongst all philosophers of any experimental and naturalist school in propounding an objective theory of the Universe. Of course, the theological, idealist, and ontological schools of thought have ever regarded it as the crown of philosophy

to solve the mystery of the Universe. But Spencer alone has ventured to face this abysmal problem by a scheme of logical deductions from the positive sciences, from the experience of a multiplicity of real observations of the phenomena of Nature and Man. What the 'Ideas' were to Plato, or the Church to Aquinas, or the Categories to Kant, that, and more than that, Evolution is to Spencer. 'Throughout the Universe, in general and in detail, there is an unceasing redistribution of matter and motion.' Thus he opens his new Book of Genesis.

Surely, the most ardent Spencerian will hardly contend that this enormous claim has been admitted as yet at the tribunal of contemporary philosophy. To my own humble intelligence it sounds a paradox to find one, who is so keen a believer in the relativity of all knowledge, so ruthless an antagonist of any dogmatizing about the Absolute or Unconditioned Existence, the apostle, in fact, of the limitless and mystical Unknowable, the sad meditator on the infinitesimal littleness of man and his planetary speck amid the numberless millions of far grander suns—to find him, I say, revealing to us the Law of the whole Universe, on grounds, be it said, not of revelation, not of intuition, not on the *a priori* logic of *pure reason*, not of the still small voice innate in the human soul, but on grounds of demonstrated science, drawn from real observations and the record of our senses in experience.

According to the far humbler school in which I have been trained, any *Objective* synthesis, i. e. any co-ordination of our knowledge of phenomena according to their actual order *in rerum natura*, is an impossible Utopia. A true 'Cosmic philosophy,' to use the term of Spencer's American disciple, Prof. Fiske, is beyond the

range of our relative powers of mind. Any real synthesis of our knowledge of phenomena must be one relative to the powers of the human observation and reflection—not claiming to be any record of things as they are in the Universe. It is difficult to see how such a panorama of an objective world of things differs from the transcendental conception of 'Dinge an Sich.' The spectacle presented to our very limited powers of vision and of thought by such petty corner of the Unfathomable Universe as may be within our ken is still of itself so vast, so complex, so shifting, so subtle, and yet to us so infinite, that it must ever baffle our efforts to reach farther than a simple tabulation of what is within our range of mental vision. As well ask the painter of a grand landscape to draw, not what he sees from his standing-point, but every object which is actually present within the horizon—nay, beyond the horizon—and every object, not in just perspective as visible to the human eye, but in its actual proportion to all other objects around it.

I must assume that those who hear me are familiar with the famous sixteen propositions in which Spencer, in many successive publications, formulated what he called 'the cardinal principles developed in his works.' It was 'that process of transformation going on throughout the Cosmos as a whole, and in each larger or smaller part of it.' They know too how the final definition of Evolution ran thus: '*Evolution is an integration of matter and concomitant dissipation of motion, during which the matter passes from a relatively indefinite, incoherent homogeneity to a relatively definite, coherent heterogeneity; and during which the retained motion undergoes a parallel transformation.*' And the Telos of the entire Synthetic Philosophy, as I understand it, is

to show that this law of evolution, with its corollary and associated laws, will explain the phenomena of our own world and our own race, as well as those of the Cosmos and of all things, organic and inorganic. These laws lie at the basis of Astronomy, Physics, Biology, Psychology, Sociology, and Ethics. These primary and universal laws would thus form a complete co-ordination of all our knowledge.

It is not assuming too much if we conclude that these laws are very widely admitted to possess, not only a very general application, but also to have a rare illuminating power in an immense number of special sciences. This would be admitted by most Physicists, and by the bulk of all adherents to the philosophy of experience. They constitute something which may be called a *Novum Organum* of scientific thought. But it would be, surely, going too far even for avowed Spencerians to claim, either, (1) that these laws are of *universal* application, or (2), that they form an adequate scheme of general science, a full synthesis of human knowledge. For my own part, admitting for these sixteen principles a high generality, and that they throw a most original light on philosophy, I must note some points in which we must await fresh elucidation.

If these sixteen propositions sum up the entire Synthetic Philosophy in germ, if the movement of Evolution and Dissolution, through alternate differentiation and integration, is the master-key of all science, then science is simply the law of the processes of Change. But the laws of *stability*, of permanence, are equally essential and dominant; indeed they come prior to laws of change. Using the terms in their true philosophic breadth, *Order* precedes *Progress*, determines it, and regulates it. *Progress is evolution out of Order.* That is to say, the course

of every development is irrevocably determined when the primordial type is constituted. The Child is father of the Man. But the child has all the essential organic features out of which the man is developed.

The orthodox Spencerian would possibly reply—there is no such thing as stability *in rerum natura.* Everything is in Evolution, from the solar system to the last theory about taxation, and the latest novelty in dress or in games. Absolutely, no doubt, we have no example of rigid immobility. The sun, the everlasting mountains, human nature—all are changing, however subtle and invisible to us be the process. But *relatively*, an immense body of our observations, and nearly half our scientific knowledge, deal with phenomena of apparent stability, order, permanent type. It would be riding to death the old apophthegm of Heracleitus—πάντα ρεῖ—to think of things only in *flux*, to ignore the vast field of Persistence of Type as dominating change. To those who reject the relativity of knowledge, it may be open to disregard mere relative permanence in a universe of absolute movement. This is not open to those who regard all our knowledge as relative, not absolute, to whom it is wholly based on experience.

For all practical purposes of reasoning, our experience reports a vast substratum of stability; and its laws and its conditions are as essential to all reasoning as the laws of change. It is one of the inherent vices of the objective synthesis, that it has to banish *Statics* from its scheme, and to concentrate its study on *Dynamics* alone. It is the intellectual and moral disease of our time to despise everything that is not in constant *flux.* The Philosophy of Evolution is limited *ex hypothesi* and *ex vi termini* to *dynamical* movements. But it is not true that Science consists

solely of dynamical laws. The laws of Type, of a stability *relative* to human observations, are antecedent in fact, and also in order of thought. Complete philosophy must rest on a theory at once statical and dynamical. A full science of Ethic cannot be constituted by tabulating in a series the changes recorded in moral sentiment, whilst wholly ignoring the permanent instincts of the human heart, the qualities of the human will, the powers of the human intelligence, and the personal, domestic, tribal, and national institutions which cling round man under all conditions of development. In Ethic these types and axiomatic forms are far more dominant, and even more conspicuous, than are the changes and developments. We do not doubt that Ethic is subject to incessant development. But relatively and for real knowledge, the fixed types, even if only apparently fixed, are far more essential to us.

The successors of Spencer have got to face the big problem of the application of the Evolution Philosophy to the entire field of the Inorganic sciences. Spencer himself omitted these altogether on palpably insufficient grounds. Had he boldly attempted to show the relation of his sixteen dogmas to the Physical Sciences, to Astronomy, to Physics with all its corollaries, to Chemistry, and to Mechanics, he must have been confronted with the dilemma—how little any mere theory of Evolution and Dissolution, apart from any theory of invariable Order and Type, would serve to illumine any inorganic science. To the Astronomer, the Solar System may be bodily moving towards the constellation Hercules; the Sun and the Earth may be cooling; and the orbit of the Planets may be infinitesimally diminishing. But the essential laws are the

almost, or apparently, fixed laws of planetary revolutions. To the physicist, the laws of gravitation, of molecular activity, of electric force, are not in *flux*, or, at least, are not in any serial Evolution, but are statical. To the chemist, evolution of any kind is absorbed in the invariable action of the elements and their compounds. Can Evolution solve any problem of radium or of X-rays?

To me it is a sad thought that the Synthetic Philosophy was never completed by its founder, so as to fill up the enormous *lacuna* left in it by the gap of the whole range of the Inorganic Sciences. It leaps from First Principles, said to apply to the whole range of knowledge, to Biology, Psychology, and Sociology, jumping across this vasty deep of Mathematics, Geometry, Astronomy, Physics, with all its ramifications of Barology, Thermology, Electricity, and the rest. Nor does Chemistry appear at all. Spencer from time to time touches on Astronomy and on Geology, so far as the laws of evolution bear upon the origin of the Solar System, and the formation of the strata of the Earth. But I do not remember a word as to the regular and double movement of our planet, or the solar system viewed as a permanent scheme of invariable Mechanics. But these are of infinitely greater interest, both scientifically and for all human ends, than are hypotheses about the Nebular Universe and its gradual modifications. How the conceptions of Gravitation, of the volumes and combinations of gases, of the transmission of light, of heat, of electric energy, can be reducible to terms of *Change* and *growth*, apart from persistence and invariable action—this is a mystery which at present seems buried with Spencer.

This attempt to reduce the essential laws of every

science to terms of change and movement must have a mischievous effect on subsequent inquiries. It would be ludicrous to limit Astronomy to hypotheses about the origin of the Solar System, and to limit Geology to speculations how the Earth came about, neglecting all notice of the Earth as we find it. It is an attempt to write a new Book of Genesis—based not on Revelation, not on observation of facts, but on unverifiable hypotheses. And all the time the student of Astronomy is left uninstructed as to the Precession of the Equinoxes, and the effect on the Earth of Sun-spots; and the student of Geology is left in the dark as to the extent and disposition of the Coal Measures. We know in this University only too well the consequences of limiting Science to a matter of *Origins*. The student of History, whose views about the French Revolution are quite rudimentary, is full of learning about the Mark System. And the candidate for a degree in Law, who is hazy about the Statute of Frauds or the Wills Acts, is voluble about the Witenagemot and the Laws of Ina.

I pass to another difficulty which the scheme of Universal Evolution presents to many minds. It propounds a single set of laws which claim to be equally applicable to all the sciences, both cosmical and human; and, more than that, it claims to supply us with an adequate but general elucidation of all phenomena in the Universe, on our Earth, and in human nature. At the close of his famous essay, *Reasons for dissenting from the Philosophy of M. Comte*, Spencer challenges Positivists to show that Comte ever held his view, '*that the factors producing changes of all kinds, inorganic and organic, co-operate everywhere throughout the Cosmos in the same general way, and everywhere work meta-*

morphoses having the same essential traits.' I venture to think that Positivists would warmly join with Spencer in denying that Comte held any such view, that he countenanced any such conception about the Cosmos or the general sciences. To followers of Comte it would be a fatal blot on any system of philosophy to use any uniform set of laws as an adequate logic of all the sciences in turn—assuming that any single set of principles sufficed to explain and co-ordinate the sciences within each, and co-ordinate one with another.

Comte, on the contrary, emphatically insists that the laws, the methods, and the principles of the different sciences are always different and distinct, practically incommensurable and not interchangeable. He holds that each general science has its own logic, its own generalization. Students of the Positive Philosophy do not need to be reminded that the Synthesis or co-ordination of the sciences, as proposed by Comte, consists, not in applying to them all alike one set of formulae, but in tracing their concatenation and mutual relations. To attempt a co-ordination of the sciences on one uniform theory—such theory primarily applied to the material world—inevitably forces the philosopher to reduce all social and moral problems to the terms of cosmical and physical problems, and ultimately to terms of molecular physics and mechanics. And this in fact is exactly what has happened. The cardinal principles of the Synthetic Philosophy are all formulated in terms that apply to the whole Solar System, and indeed to the original molecular basis of the Universe. If the Universal laws of Evolution and Dissolution and their corollaries—segregation, integration and differentiation—govern and explain the phenomena of the Universe, then social and moral progress has to be explained

in the language of Physics and Mechanics. In the school in which I have been trained this is known as Materialism in the strict sense of that word, which I take to be—reasoning about the soul of man, as if its functions were simply those of material units. This degradation of Science is repudiated, not only by Theology and by Metaphysics, but no less emphatically by Positive Philosophy.

The whole series of the human sciences, Psychology, Language, Art, Sociology, History, Economics, Ethic, and Politic—such branches of Knowledge as treat man otherwise than as an animal—have their special laws, their own logic, their own moral fibre, their own spiritual conclusion, quite incommensurable with the non-human sciences. Mechanics, Physics, Chemistry, Biology undoubtedly explain Man as an animal. But they never can explain Man as a loving, sympathetic, social, moral, religious being. This side of Man's nature, the greatest side of his nature, the largest, most dominant, and most sublime fact in all Nature, can only be explained by Social Science, solid Philosophy, true Religion. As the poet saw it in a vision, the last man shall proudly confront in his conscious superiority the waning and unconscious sun. The central and vivifying life-blood of this Social Science, of this Philosophy, of this Religion, must be—not Evolution, or the transformation of the homogeneous into the heterogeneous by continuous differentiation and integration—No! It must complete the development of humanity by Faith, Hope, and Love.

To attempt in any single scheme a Key to all the Sciences is as futile as a 'Key to all the Mythologies.' Matter and Thought are irreducible, for neither can be stated in terms of the other. The same is true of the

Organic and the Inorganic worlds, of the Human and the Non-human worlds, of the Physical and the Moral worlds, of the Cosmical and the Social worlds, of the law of Progress and the law of Order. On all sides we are confronted with a series of Antinomies, Dualisms, and irreducible ultimate conceptions. The World and Humanity are not reducible to any common measure. If *objectively*, and *in rerum natura*, the World is everywhere in eternal *flux*; *relatively* and *humanly*, the world of inorganic Nature is in a state of comparative permanence and stability as compared with the organic world. So the Non-human world is relatively in a state of fixity as compared with the Human world and its infinitely complex and subtle laws of progress. The Evolution of Man is infinitely more subtle, more continuous, more important to us than the Evolution of the Physical world. Wonderful as may be the Evolution of the Horse from Eohippus and Hipparion in ten or twenty millions of years, the evolution of Man in ten or twenty centuries is infinitely more marvellous, and is certainly more complex—and perhaps is more useful for us to know. No formula which explains the Evolution of the Horse, and of Man, in terms of the Evolution of the Milky Way and the Nebula of Orion, can be a very fertile organum of thought. It does not advance us much to be furnished with a set of formulas which profess equally to explain the rotation of the earth and the French Revolution, the pressure of the atmosphere and the growth of the moral sense, the Precession of the Equinoxes and the social improvement of women, the indivisibility of molecules and the rise and growth of the Catholic Church. And this law is the perpetual 'transformation from an indefinite incoherent homogeneity to a definite, coherent hetero-

geneity, through successive differentiation and integration!' That may all be quite true. I hold it to be very largely true, and profoundly suggestive. But it is not definite enough—not specific, not itself sufficiently differentiated. Mill, adopting a phrase of Novalis, called Comte a 'morality-intoxicated man.' Comte might perhaps have looked on Spencer as a man intoxicated with evolution.

It is a singular fact that the Synthetic Philosophy of Evolution contains no history of human civilization in its entirety, as a continuous biography of man. There is not in it, and never was even projected, any Philosophy of general History, the Dynamics in fact of Sociology. In the 'Principles of Sociology' there are a body of acute but miscellaneous observations, and some profound suggestions, as to the origin of institutions, primitive habits, rudimentary groups. But we never get further than glimpses of savage life, the variations in primaeval rites, and the survival of ancient customs. In all Spencer's vast output there is nothing that can be called any theory of general history. What we have is the *embryology* of society. But no science is constituted, if its conclusions are limited to embryology.

Take the rise of the Persian Empire in the East, when pre-historic and most disparate tribes were consolidated into a military tyranny. Is that adequately explained by the law of 'Transformation from an indefinite homogeneity to a definite heterogeneity?' Take the course of the Greek world from Agamemnon to Alexander. Is that a change from homogeneity to heterogeneity? Or take the Roman world from Romulus to Trajan. Was it more homogeneous in the first century of Rome than in the first century A. D.? Was

the civilized world in the ninth century more coherent than it had been in the first century after Christ? Take the rise and development of the Catholic Church, or the history of Christendom from the time of St. Paul to our day. They may be more heterogeneous to-day, but is either more definite, more consistent now? Spencer's laws offer us illuminating flashes of light across that vast waste of troubled waters that we call the history of mankind. But continuous history was to Spencer a sealed book. He so misread such pages as he ever opened that we can hardly wish it had been otherwise.

Over the coffin which held the mortal remains of Herbert Spencer an eloquent friend pronounced a magnificent eulogy. He said, 'All history, all science, all the varying forms of thought and belief, all the institutions of all the stages of man's progress were brought together; and out of this innumerable multitude of data emerged one coherent, luminous, and vitalized conception of the evolution of the world.' It is a noble ideal towards which Spencer toiled with heroic constancy for forty years. It is an ideal which no English philosopher has ever essayed to reach, an ideal towards which Spencer contributed germs of imperishable truth. Would that I could join in the confidence that this mighty Ideal had been achieved! When I reflect on the enormous gaps in the Synthetic System, the absence of any continuous theory of general history, the absence of any systematic treatment, or even of any sketch, of all the Inorganic Sciences—Mechanics, Astronomy, Physics, Chemistry—I reluctantly am forced to regard the claim, that out of *all history, all science*, Spencer has evolved 'one coherent conception,' as being far beyond the truth. And when I reflect on the claim, that the

one supreme conception of Evolution, with its monotonous, rigid, mechanical dogmas, sufficed to illustrate and even to co-ordinate all phenomena, both cosmical and human, I even begin to doubt if the very basis of the Evolution system were on sound philosophical lines.

Even if this were so, Spencer happily was far too great a philosopher, far too acute and observant of facts, too much saturated with scientific learning of all kinds, to suffer himself to be overweighted and confined by the materialistic dogmas with which he set forth. Though he gave the world no continuous view of general history, he endowed historical research with a series of brilliant elucidations. Though he leapt across the vast chasm of the Inorganic Sciences in his eagerness to come to Life, to Mankind, to Right and Wrong in human conduct, he turned his powerful searchlight upon one science after another, as it swept round the horizon with its rapidly revolving flash. He, who hotly rejected any serial order in the sciences, in practice evolved his own synthesis in regular series; nay, he built up his whole system in the very serial order for which he had condemned a rival philosophy. And, though he sought to base the Philosophy of Evolution on a set of dogmas as purely physical as if they applied to nothing but celestial mechanics, in the end Spencer devoted the whole strength of his great brain and his spiritual sense of justice, honour, and benevolence in the brotherhood of Man, to the supreme science of society and of morality. Never did Philosophy open with aspect more physical. Never did it insist more imperatively on the law of Justice from man to man, on the supreme duty of Altruism.

Over the portal of the Evolution Philosophy I see

engraved these words:—'Throughout the Universe, in general, and in detail, there is an unceasing redistribution of matter and of motion.'

Over the portal of every Synthetic Philosophy which can command the full assent of the ages to come, I can conceive there will be seen some such aphorisms as these:—

> 'Order is the Foundation—Progress the end.'
> 'Progress is the development of Order.'
> 'Live for others.'
> 'Man becomes more and more religious, as he becomes more wise, more just, more loving.'

And I feel an assurance beyond words that these axioms are more true, lie nearer to the soul of man, and will prove more fit to advance and ennoble our life on earth.

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1906

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MR. SPENCER AND THE GREAT MACHINE

I

I BEGAN my lecture at Oxford by expressing my sense of the debt that we owed to Mr. Spencer for his splendid attempt to show us the great meanings that underlie all things—the order, the intelligibility, the coherence, that exist in this world of ours. I confessed that, on some great points of his philosophy, I differed from his teaching, parting, so to speak, at right angles from him; but that difference did not alter my view of how much he had helped us in the clear bold way in which he had traced the great principles running through the like and unlike things of our world; and in which with so skilful a hand he had grouped the facts round those principles, that he always followed—might I say—with the keen instinct of a hound that follows the scent of the prey in front of him. Time, I thought, might take away much, and might add much; but the effort to unite all parts of the great whole, to bind and connect them all together, would remain as a splendid monument of what one man, treading a path of his own, could achieve.

But to-day we are only concerned with his social and political teaching, where we may, I think, follow his leading with more reliance, and with but little reserve. I have often laughed and said that, as far as I myself was concerned, he spoilt my political life. I went into the House of Commons, as a young man, believing that

we might do much for the people by a bolder and more unsparing use of the powers that belonged to the great law-making machine; and great, as it then seemed to me, were those still unexhausted resources of united national action on behalf of the common welfare. It was at that moment that I had the privilege of meeting Mr. Spencer, and the talk which we had—a talk that will always remain very memorable to me—set me busily to work to study his writings. As I read and thought over what he taught, a new window was opened in my mind. I lost my faith in the great machine; I saw that thinking and acting for others had always hindered not helped the real progress; that all forms of compulsion deadened the living forces in a nation; that every evil violently stamped out still persisted, almost always in a worse form, when driven out of sight, and festered under the surface. I no longer believed that the handful of us—however well-intentioned we might be—spending our nights in the House, could manufacture the life of a nation, could endow it out of hand with happiness, wisdom and prosperity, and clothe it in all the virtues. I began to see that we were only playing with an imaginary magician's wand; that the ambitious work we were trying to do lay far out of the reach of our hands, far, far, above the small measure of our strength. It was a work that could only be done in one way—not by gifts and doles of public money, not by making that most corrupting and demoralizing of all things, a common purse; not by restraints and compulsions of each other; not by seeking to move in a mass, obedient to the strongest forces of the moment, but by acting through the living energies of the free individuals left free to combine in their own way, in their own groups, finding their own experience, setting before

themselves their own hopes and desires, aiming only at such ends as they truly shared in common, and ever as the foundation of it all, respecting deeply and religiously alike their own freedom, and the freedom of all others. And if it was not in our power,—we excellent and worthy people,—fighting our nightly battle of words, with our half-light, our patchwork of knowledge, and our party passions, often swayed, in a great measure unconsciously, by our own interests, half autocrats, half puppets, if it was not given to us to create progress, in any true sense of the word, and to present it to the nation, ready-made, fresh from our ever busy anvil, much in the fashion that kind-hearted nurses hand out cake and jam to expectant children; if all this taking of a nation's life out of its own hands into our hands was but a bewildered dream, a careless conceit on our part, might it not, on the other hand, be only too easily in our power to mislead and to injure, to hinder and destroy the voluntary self-helping efforts and experiments that were beyond all price, to depress the great qualities, to soften and break down the national fibre, and in the end, as we flung our gifts broadcast, to turn the whole people into two or three reckless quarrelling crowds, that had lost all confidence in their own qualities and resources, that were content to remain dependent on what others did for them—ever disappointed, ever discontented, because the natural and healthy field of their own energies had been closed to them, and all that they now had to do was to clamour as loudly as possible for each new thing that their favourite speakers hung in glittering phrases before their eyes? I saw that no guiding, no limiting or moderating principle existed in the competition of politician against politician; but that almost all hearts were filled with the old corrupting desire, that had so long

haunted the world for its ceaseless sorrow, to possess that evil mocking gift of power, and to use it in their own imagined interest—without question, without scruple—over their fellow men. From that day I gave myself to preaching, in my own small way, the saving doctrine of liberty, of self-ownership and self-guidance, and of resisting that lust for power, which had brought such countless sufferings and misfortunes on all races in the past, and which still, to-day, turns the men and women of the same country, who should be as friends and close allies, if the word 'country' has any meaning, into two hostile armies, ever wastefully, uselessly, and to the destruction of their own happiness and prosperity, striving against each other, always dreading, often hating, those whom the fortunes of war may at any moment make their masters. Was it for this—this bitter, reckless and rather sordid warfare—I tried to ask—that we were leading this wonderful earth-life; was this the true end, the true fulfilment of all the great qualities and nobler ambitions that belonged to our nature?

Now, whether you judge that I acted rightly or wrongly in thus yielding myself to Mr. Spencer's influence, you will not, I think, quarrel very seriously with me, if I say that between Mr. Spencer's mind and the mind of the politician there lies the deepest of all gulfs; and that there is no region of human thought which is so disorderly, so confused, so lawless, so little under the rule of the great principles, as the region of political thought. It must be so, because that disorder and confusion are the inevitable consequence and penalty of the strife for power. You cannot serve two masters. You cannot devote yourself to the winning of power, and remain faithful to the great principles. The great principles, and the tactics of the political

campaign, can never be made one, never be reconciled. In that region of mental and moral disorder, which we call political life, men must shape their thoughts and actions according to the circumstances of the hour, and in obedience to the tyrant necessity of defeating their rivals. When you strive for power, you may form a temporary, fleeting alliance with the great principles, if they happen to serve your purpose of the moment, but the hour soon comes, as the great conflict enters a new phase, when they will not only cease to be serviceable to you, but are likely to prove highly inconvenient and embarrassing. If you really mean to have and to hold power, you must sit lightly in your saddle, and make and remake your principles with the needs of each new day; for you are as much under the necessity of pleasing and attracting, as those who gain their livelihood in the street. We all know that the course which our politicians of both parties will take, even in the near future, the wisest man cannot foresee. We all know that it will probably be a zig-zag course; that it will have 'sharp curves', that it may be in self-evident contradiction to its own past; that although there are many honourable and high-minded men in both parties, the interest of the party, as a party, ever tends to be the supreme influence, overriding the scruples of the truer-judging, the wiser and more careful. Why must it be so, as things are to-day? Because this conflict for power over each other is altogether different in its nature to all other—more or less useful and stimulating—conflicts in which we engage in daily life. As soon as we place unlimited power in the hands of those who govern, the conflict which decides who is to possess the absolute sovereignty over us involves our deepest interests, involves all our rights over ourselves,

all our relations to each other, all that we most deeply cherish, all that we have, all that we are in ourselves. It is a conflict of such supreme fateful importance, as we shall presently see in more detail, that once engaged in it we *must* win, whatever the cost; and we can hardly suffer anything, however great or good in itself, to stand between us and victory. In that conflict affecting all the supreme issues of life, neither you nor I, if we are on different sides, can afford to be beaten. Think carefully what this conflict and what the possession of unlimited power in plainest matter of fact means. If I win, I can deal with you and yours as I please; you are my creature, my subject for experiment, my plastic material, to which I shall give any shape that I please; if you win, you in the same way can deal with me and mine, just as you please; I am your political plaything, 'your chattel, your anything.' Ought we to wonder that, with so vast a stake flung down on the table, even good men forget and disregard all the restraints of their higher nature, and in the excitement of the great game become utterly unscrupulous? There are grim stories of men who have staked body and soul in the madness of their play; are we after all so much unlike them—we gamesters of the political table—staking all rights, all liberties, and the very ownership of ourselves? And what results, what must result from our consenting to enter into this reckless soul-destroying conflict for power over each other? Will there not necessarily be the ever-present, the haunting, the maddening dread of how I shall deal with you if I win; and how you will deal with me if you win? That dread of each other, vague and undefined, yet very real, is perhaps the worst of all the counsellors that men can admit to their hearts. A man

who fears, no longer guides and controls himself; right and wrong become shadowy and indifferent to him; the grim phantom drives, and he betakes himself to the path—whatever it is—that seems to offer the best chance of safety. We see the same vague dread acting upon the nations. At times you may have an aggressive and ambitious Government, planning a world-policy for its own aggrandizement, that endangers the peace of all other nations; but in most cases it is the vague dread of what some other rival nation will do with its power that slowly leads up to those disastrous and desolating international conflicts. So it is with our political parties. We live dreading each other, and become the reckless slaves of that dread, losing conscience, losing guidance and definite purpose, in our desperate effort to escape from falling under the subjection of those whose thoughts and beliefs and aims are all opposed to our own. True it is that the leaders of a party may have their own higher desires, their own personal sense of right, but it is a higher desire and sense of right which they must often with a sigh—or without a sigh—put away into their pockets, bowing themselves before the ever present necessity of winning the conflict and saving their own party from defeat. The stake is too great to allow room for scruples, or the more delicate balancings of what is right and wrong in itself. We all know—'Need must, when the devil drives.' 'Skin for a skin, what will a man not do for his skin.'

Now let us look how that winning of the political battle has to be done? Winning means securing for our side the larger crowd; and that can only be done, as we know in our hearts, though we don't always put it into words, by clever baiting of the hook which is to

catch the fish. It is of little use throwing the bare hook into the salmon pool; you must have the colours brightly and artistically blended—the colours that suit the particular pool, the state of the water, the state of the weather. Unless you are learned in the fisherman's art, it is but few fish you will carry home in your basket. So in the political pool you must skilfully combine all the glittering attractions that you have to offer; you must appeal to all the different special interests, using the well chosen lure for each. It is true that there may be exceptional moments with all nations when the political arts lose much of their importance, when some great matter rises above special interests, and the people also rise above themselves. But that is human nature at its best; and not the human nature as we have to deal with it on most days of the week. It is also true that the best men in every party stoop unwillingly; but, as I have said, they are not their own masters; they are acting under forces which decide for them the course they must follow, and reduce to silence the voice within them. They have gone in for the winning of power, and those who play for that stake must accept the conditions of the game. You can't make resolutions—it is said—with rose-water; and you can't play at politics, and at the same time listen to what your soul has to say in the matter. The soul of a high-minded man is one thing; and the great game of politics is another thing. You are now part of a machine with a purpose of its own—not the purpose of serving the fixed and supreme principles—the great game laughs at all things that stand before and above itself, and brushes them scornfully aside, but the purpose of securing victory; and to that purpose all the more scrupulous men must conform, like the weaker brethren,

or—as the noblest men do occasionally—stand aside. As our system works, it is the party interests that rule and compel us to do their bidding. It must be so; for without unity in the party there is no victory, and without victory no power to be enjoyed. When once we have taken our place in the great game, all choice as regards ourselves is at an end. We must win; and we must do the things which mean winning, even if those things are not very beautiful in themselves. And what is it that we have to do? In plain words—and plainness of thought, directness of speech, is the only wholesome course—we must buy the larger half of the nation; and buying the nation means setting up before all the various groups, of which it is composed, the supreme object, the idol of their own special interests. We must offer something that makes it worth while for each group to give us their support, and that something must be more than our rivals offer. Put your own self-interests in the first place, and see that you get them—is the watchword of all politics—though we don't often express it in those crude and unashamed terms. Political art has, like many another accomplishment, its own refinements for half veiling the real meanings. If we wish to do our work in the finer fashion, in the artist's way, we must use the light and skilful hand; we must mix in the attractive phrases, appeal to patriotic motives, borrow—a little cautiously—such assistance as we can from the great principles—a slight passing bow that does not too deeply commit us to their acquaintance as regards the future—and throw dexterously over it all—as a clever cook introduces into her dishes her choicest seasoning—a flavour of noble and disinterested purpose. It is a fine art of its own, to buy, and at the same time to gild and beautify the buying; to get the voter into

the net, and at the same time to inspire him with the happy consciousness that, whilst he is getting what he wants, he is through it all the devoted patriot, serving the great interests of his country. And then also you must study and understand human nature; you must play—as the skilled musician plays on his instrument—on all the strings—both the higher and lower—of that nature; you must utilize all ambitions, desires, prejudices, passions and hatreds—lightly touching, as occasion offers, on the higher notes. But in this matter, as in all other matters, underneath the fine words, business remains business; and the business of politics is to get the votes, without which the great prize of power could not by any possibility be won. Votes must be had—the votes of the crowd, both the rich and the poor crowd, whatever may be the price which the market of the day exacts from those who are determined to win.

II

So rolls the ball. We follow the inevitable course that seeking for power forces upon us. Politics, in spite of all better desires and motives, become a matter of traffic and bargaining; and in the rude process of buying, we find ourselves treading not only on the interests, but on the rights of others, and we soon learn to look on it as a quite natural and unavoidable part of the great game. Keener and keener grows the competition, more heart and brain-absorbing grows the great conflict, and the people and the politicians cannot help mutually corrupting each other. This buying up of the groups is so distinctly recognized nowadays, that lately a *Times* correspondent—whose letters we read with much interest—speaking of a newly formed

ministry abroad, wrote, with unconscious cynicism, that it would have to choose between leaning on the extreme right or the extreme left.

What then—you may say—are we to believe; that the whole body of those concerned with politics—in which class we almost all in our degree are included——are selfish and corrupt, utterly disregarding and despising the just claims of each other? I hope things are not quite so bad as that. Human nature is a mixed thing, and many of us contrive to think in the nobler way and the smaller way at the same time. There is at least one excuse that may be pleaded for us all. What happens here—as happens in so many other cases—is that carelessly and without reflection we place ourselves under an untrue, a demoralizing and wrong system, that fatally blinds and misleads us, lowers and blunts the better part of our nature, and almost compels us, by the force that it exerts, to follow crooked paths and do wrong things. I have not time to illustrate this simple truth of the sacrifice of character to system; but let me take one instance of the injury that results, whenever we lose our own self-guidance under a system, that is wrong in itself, and, as a wrong system so often is apt to be, despotic in its nature. I think many of us see the existence of this injury as regards character, when we watch that part of fashionable society which makes of organized pleasure-hunting the first occupation—I might almost say the duty—of life. Here also people construct a system which overpowers their individual sense of what is right and useful and fitting; they submit themselves to the tyrannous rule of follies of different kinds, as if they had no judgement, no discriminating sense of their own, and as a consequence become as a mere race of butterflies, losing

the higher sense of things, and wasting their lives. In all such instances, where lies the remedy? I think both Mr. Spencer and Mr. Mill would have made the same answer—you can only mend matters by individualizing the individual. It is of little use preaching against any hurtful system, until you go to the heart of the matter, until you restore the individual to himself, until you awaken in him his own perceptions, his own judgement of things, his own sense of right, until you allow what Mr. Spencer called his own apparatus of motive—and not an apparatus constructed for him by others—to act freely upon him—an apparatus that tends sooner or later to work to the better things; and so detach him from his crowd, which whirls him along helplessly, wherever it goes, as the stream carries its unresisting bubbles along with it. There lies the great secret of the whole matter. We have as individuals to be above every system in which we take our place, not beneath it, not under its feet, and at its mercy; to use it, and not to be used by it; and that can only be when we cease to be bubbles, cease to leave the direction of ourselves to the crowd—whatever crowd it is—social, religious, or political—in which we so often allow our better selves to be submerged.

It was for this individualizing of the individual that both Mr. Spencer and Mr. Mill pleaded so powerfully; only in the free individual, self-restraining, self-guiding, that they saw, I think, the hope of true permanent good. They saw that nobody yet has ever been saved—in the best sense—or ever will be saved by vast systems of machinery; Mr. Mill, perhaps, specially looking from the moral point of view, and Mr. Spencer contrasting the intellectual and material consequences of the two opposed systems—self-guidance, and guidance by others.

And here, perhaps, I ought to add a few words. Whilst we lay the heaviest share of blame upon the political system that takes possession of us, and leaves little room for self-guidance, are we to lay no direct blame upon ourselves, for being content to take our place in the system, that few, I think, in calm moments of reflection, can fully justify to their own hearts? Let us be completely frank in this great matter. Is the system of giving away power over ourselves, or seeking to possess it over others, in itself right or wrong? If it is wrong, don't let us make excuses for acquiescing in it; don't let us sigh and feebly wring our hands, confessing the faults and dangers, but pleading that we see no other way before us. Where there is a bad way, there is also a good way, if men once resolutely set themselves to find it. But you may, perhaps, doubt if the system *is* wrong in itself; if it is not merely perverted and turned from its true purpose by our human weaknesses. You may be inclined to plead—'It is true that politicians must suppress a part of their own opinions; it is true that there is a sort of bargaining that goes on among the groups, that in order to gain their own special end, they have to act with other groups—groups which may differ strongly from themselves on some important points; it is true also that the leaders of a party must take all these groups into their calculations; and as our American friends say—placate the interests; but there is not necessarily anything corrupt in such action on the part of either the groups or the politicians, or their leaders, at least so long as we can fairly credit them all with desiring the common good, at the same time as they pursue their own special interests, and doing the best that the situation allows alike for these two ends; even if these ends may occasionally diverge

somewhat from each other. Of course we admit that men may be easily tempted to overstep the just and true line, may be tempted in the rivalry of parties, in the strife for power, in the desire to seize the glittering prize, to forget for a while the common good, to push it back into the second place, to be over-keen about their own interests; no doubt the possession of power has its dangers, and tempts many men to say and do what we cannot defend; but we must trust to the general better and wiser feeling of the whole people, or of the whole party, to hold in check these aberrations of some of the fighters, and to strike the balance fairly between the two influences. We must remember that all action in common demands some sacrifices; has its disabilities, as well as its great advantages. We cannot act together, unless there is a considerable—sometimes a large suppression of our own selves. We must accept that bit of necessary discipline; we must be prepared to keep step with the marching—(or ought you to say the manœuvring)—regiment, if we are to achieve anything by united action, and not to remain as separate sticks, that no bond holds together. All through life the same principle runs. In every club, society, joint-stock undertaking, we submit to guidance; we give up a part of our views and desires to gain the more important object—yet when we do so, nobody accuses us of sacrificing our own guiding sense, or of being corrupt, or of entering into a hurtful and dangerous traffic.

Yes—I should reply—but in all these voluntary associations you retain your own free choice; you can enter into them or leave them, as you think right; and that free choice in all these cases is the saving element. But I ought to ask pardon of our friend, the

apologist, for interrupting him. 'Even if our political system'—it is our friend who is again speaking—'has its defects—grave defects if you like—still after all, it is the instrument of progress, and we know of no other to take its place. Surely it is more profitable to try to mend its faults, than to quarrel with the whole thing, for which we can see no substitute.' That I think is a fair representation of the way in which many of us look at political life, a way that perhaps supplies us with some momentary consolation, when our minds are troubled with what we see passing before us; but how far, if we try to see quite clearly, can we accept such reasoning, as giving any real answer to the graver doubts and hesitations? Is it not only a bit of agreeable sticking-plaster, laid over the sore place, an opiate-like soothing of troubled consciences, hardly intended seriously to touch the deeper part of the matter? Let us now try to look frankly beneath the surface, and do our best to see what is the true nature of the system in which we so easily acquiesce.

What does representative government mean? It means the rule of the majority and the subjection of the minority; the rule of every three men out of five, and the subjection of every two men. It means that all rights go to the three men, no rights to the two men. The lives and fortunes, the actions, the faculties and property of the two men, in some cases their beliefs and thoughts, so far as these last can be brought within the control of machinery, are all vested in the three men, as long as they can maintain themselves in power. The three men represent the conquering race, and the two men—*vae victis* as of old—the conquered race. As citizens, the two men are de-citizenized; they have lost all share for the time in the possession of their country,

they have no recognized part in the guidance of its fortunes; as individuals they are de-individualized, and hold all their rights—if rights they have—on sufferance. The ownership of their bodies, and the ownership of their minds and souls—so far as you can transfer by machinery the ownership of mind and soul from the rightful owners to the wrongful owners—no more belongs to them, but belongs to those who hold the position of the conquering race. Now that is I believe a true and uncoloured description of the system, as it is in its nakedness, as it is in its real self, under which we are content to live. It is not an exaggerated description—there is not a touch in the picture with which you can fairly quarrel. It is true that the real logic of the system does not yet prevail. It is true that a certain number of things may for a time modify and restrain the final triumphs of the majority. In some parliamentary countries, the majority tends to be more composite in its character than with us, and therefore tumbles more easily to pieces. On the other hand, with us at least—whatever it may be in some other countries that have Parliaments—minorities may rend the air and reach the skies, if they can, with their cries and complaints, and so to a certain extent may raise difficulties—a method of warfare in which all minorities grow more or less skilful by practice—in the path of the majority; with us also there still exists happily a friendlier, more genial spirit between all parts of the people than prevails in other countries. Thanks to the fact that the great serpent of bureaucracy holds us as yet less closely in its folds—thanks to the still lingering traditions of self-help and voluntary work; thanks to the good humour and love of fair play, which is to some extent nursed by our fellowship in the same games that

all classes love—games that I think have redeemed some part of the politician's mistakes,—the rule of the majority is with us as yet more tempered, less violent and unscrupulous, than it is in some other countries; but give their full weight to all these modifying influences, which *as yet* restrain our system of the conquering and the conquered races from finding its full development—still they do not alter the main, the essential fact, that we are content to live under a system that vests the rights of citizenship, the share in the common country, the ownership of body, faculties, and property, and to some extent, the ownership of mind and soul, of, say, two-fifths of the nation in the hands of the three-fifths. Such is the system in which we think it right and self-respecting to acquiesce—a system which, in the case of every two men out of five, wipes out at a stroke, so far as the duties of citizenship are concerned, and even to a large extent as regards their personal relations, all the higher part of their nature, their judgement, conscience, will—treating them as degraded criminals, who, for some unrecorded offence have deserved to forfeit all the great natural rights, and to lose their true rank as men. They tell us that nowadays men are not punished for their opinions. They succeed in forgetting, I suppose, the case of every two men out five.

Plead then, if you like, on behalf of such a system all the expediencies of the moment, all the conveniences that belong to power, all the pressing things you desire to do through its machinery, plead objects of patriotism plead objects of philanthropy; yet are you right for the sake of these things—excellent as they may be in themselves—to acquiesce in that which—when stripped bare to its real, its lowest terms, is—the words are not too

harsh—the turning of one part of the nation into those who own their slaves, and the other part into the slaves who are owned? You may say, as a friend of mine says—'I feel neither like a slave-owner, nor like a slave'—but his feelings, however admirable in themselves, do not alter the system, in which he consents to take part, of trying to obtain control over his fellow men; and, if he fails, in acquiescing in their control over himself. He may never wish or mean to exercise unfairly the power in which he believes, should it fall into his hands; but can he answer for himself in the great conflict; can he answer for his allies, for the great crowd, in which he will count for such a minute fractional part, for what they will do, or where they will go?

III

My friend is quite aware, I think, that power is a rather dangerous thing to handle; but he will handle it with good sense, in the spirit of moderation and fairness, he will not suffer himself to let go of the great principles; he will not cross the boundary line that divides the rightful from the wrongful use. Well, moderation, and fairness, and good sense are excellent things, not in this matter alone, but in all matters. And so are the great principles; that is to say, if you see them in all clearness and are determined to follow them. But the saving power of the great principles depends upon how far we loyally and consistently accept them. They can be of little real help and guidance to us if we play and trifle with them, accepting them to-day, and leaving them on one side to-morrow, making them conform, as

occasion arises, to our desires and ambitions, and then lightly finding excuses for deserting them whenever we find them inconvenient. Let us once more be quite frank. When we talk of fairness and moderation and good sense, as constituting our defence against the abuse of unlimited power, are we not living in the region of words—using convenient phrases, as we so often do, to smooth over and justify some course which we desire to take, but about which in our hearts we feel uncomfortable misgivings? Let us by all means cultivate as much fairness and moderation as possible—they will always be useful—but don't let our trust in these good things lead us away from the question that—like the Sphinx's riddle—must be answered under penalties from which there is no escape:—Is unlimited power—whether with or without good sense and fairness—a right or wrong thing in itself? Can we in any way make it square with the great principles? Can we morally justify the putting of the larger part of our mind and body—in some cases almost the whole—under the rule of others; or the subjecting of others in the same way to ourselves? If you answer that it is a right thing—then see plainly what follows. You are putting the force of the most numerous, or perhaps of the most cunning, who often lead the most numerous—which, disguise and polish the external form of it as much as you like, will always remain true to its own essentially brutal and selfish nature—in the first place, making of it our supreme principle; and if unlimited power—remember it is *unlimited* power—power to do whatever the governing majority thinks right—is a right thing, must you not leave it—whatever may be your own personal views—to those who possess it to decide how they will employ it? You can't dictate to others, in the hour of their

victory, as to what they will do or not do; and they can't dictate to you, in the hour of your victory. Unlimited power—as the term expresses—can only be defined and limited by itself; if it were subject to any limiting principle, it would cease to be unlimited, and become something of a different nature. And remember always—when once you entered into the struggle for the possession of this unlimited power, that you sanctioned its existence, as a lawful prize, for which we may all rightly contend; and if the prize does not fall to you, it will only remain for you to accept the consequences of your consent to take part in the reckless and dangerous competition. By entering into that conflict, by competing for that prize, you sanctioned the ownership of some men by other men; you sanctioned the taking away from some men—say two-fifths of the nation—all the great rights, and the reducing of them to mere cyphers, who have lost power over themselves. Once you have sanctioned the act of stripping the individual of his own intelligence and will and conscience, and of the self-guidance which depends upon these things, you cannot then turn your back upon yourself, and indignantly point to the mass of unhappy individuals who are now writhing under the stripping process. You should have thought of all this before you consented to put up the ownership of the individual to public auction, before you consented to throw all these rights into the great melting-pot. In your desire to have power in your own hands, you threw away all restraints, all safeguards, all limits as regards the using of it; you wanted to be able to do just as you yourself pleased with it, when once you possessed it; and what good reason have you now to complain, when your rivals —or shall I say your conquerors—in their turn do just

what they please with it? You entered into the game with all its possible penalties; you made your bed, it only remains for you to lie on it.

Let us follow a little further this rightfulness of unlimited power in which you believe. If it is a right thing in itself, who shall give any clear and certain rule to tell us when and where it ceases to be a right thing? Is any right thing by being pushed a little further, and then a little further, and yet a little further, transformed at some definite point into a wrong thing, unless some new element, that changes its nature, comes into the matter? The question of degree can hardly change right into wrong in any authoritative way, that men with their many varying opinions will agree to accept. We may, and should for ever dispute over such movable boundary lines—lines that each man according to his own views and feeling would draw for himself. If it is right to use unlimited power to take the one-tenth of a man's property, is it also right to take one-half or the whole? If it is not right to take the half, where is the magical undiscoverable point at which right is suddenly converted into wrong? If it is right to restrict a man's faculties—not employed for an act of aggression against his neighbour—in one direction, is it right to restrict them in half a dozen or a dozen different directions? Who shall say? It is a matter of opinion, taste, feeling. Perhaps you answer—we will judge each case on its merits; but then once more you are in the illusory region of words, for, apart from any fixed principle, the merits will be always determined by our varying personal inclinations. It is all slope, ever falling away into slope, with no firm level standing place to be found anywhere. Nor do I feel quite sure, if we speak the truth, that any of us are much inclined

to accept the rule of moderation and good sense in this matter. You and I, who have entered into this great struggle for unlimited power, have made great efforts and sacrifices to obtain it; now that we have won our prize, why should we not reap the full fruits of victory; why should we be sparing and moderate in our use of it? Is not the labourer worthy of his wage; is not the soldier to receive his prize money? If power was worth winning, it must be worth using. If power is a good thing, why should we hold back our hand; why not do all we can with it, and extract from it its full service and usefulness? Our efforts, our sacrifices of time, money and labour, and perhaps of principle—if that is worth counting—were not made for the possession of mere fragmentary pieces of power, but for power to do exactly as we please with our fellow men. It is rather late in the day, now that we have won the stake, to tell us that we must leave the larger part of it lying on the table; that, having defeated the enemy, we must evacuate his territory, and not even ask for an indemnity to compensate us for our sacrifices. If power, as an instrument, is good in itself, now that we hold it in our hand, why break its point and blunt its edge? And then what about the great principles, which my friend does not propose exactly to follow, but on which at all events he will be good enough to keep a watchful eye? Where are they? What are they? What great principle remains, when you have sanctioned unlimited power? You can't appeal to any of the great rights—as rights; the rights of self-ownership and self-guidance, the rights of the free exercise of faculties, the rights of thought and conscience, the rights of property, they are no longer the recognized and accepted rules of human actions; they are now reduced to mere expediencies, to

which each man will assign such moderate value as he chooses. You are now out in the great wilderness, far away from all landmarks. Around the throne of unlimited power stretches the vast solitude of an empty desert. Nothing can be fixed or authoritative in its presence; by the fact of its existence, by the conditions of its nature, it becomes the one supreme thing, acknowledging—except perhaps occasionally in courtly phrases for soothing purposes—nothing above itself, writing its own ethics, interpreting its own necessities, making of its own safety and continuance the highest law, and contemptuously dismissing all other discrowned rivals from its presence.

Now turn from the discussion of the moral basis of unlimited power to the practical working of our power-systems. There is I think one blessed fact that runs through all life—that if a thing is wrong in itself, it won't work. No skill, no ingenuity, no elaborate combinations of machinery, will make it work. No amount of human artifice and contrivance, no alliance with force, no reserves of guns and bayonets, no nation in arms even if almost countless in number, can make it work. So is it with our systems of power. They don't work and they can't work. In no real sense, can you, as the autocrat, govern men; in no real sense, can the people imitate the autocrat and govern each other. The government of men by men is an illusion, an unreality, a mere semblance, that mocks alike the autocrat and the crowd that attempt to imitate him. We think in our amazing insolence that we can deprive our fellow men of their intelligence, their will, their conscience; we think we can take their soul into our own keeping; but there is no machinery yet discovered by which we can do what seems to us so small and easy a matter. We think that

the autocrat governs his slaves, but the autocrat himself is only one slave the more amongst the crowd of other slaves. In the first place he himself is governed by his own vast machinery; helpless he stands—one of the pitiable objects in this world of ours—in the midst of the countless wheels which he can set in motion, but which other forces direct; and then even the wheels have souls of their own, though not perhaps very beautiful ones, and ever likely to go a persistent and obstinate way of their own; but what is of deeper consequence is that his government is silently conditioned by the slaves themselves. Sunk in their darkness, helpless, inarticulate, they may be; yet for all that they in their turn are slave-owners as well as slaves, as always happens wherever you build up these great fabrics of power. Whilst the slaves obey, they also, though they utter no word, in their turn command. If the autocrat disregards that silent voice, disregards the unspoken conditions that they impose upon him, then in its own due time comes the great crash, and his power passes from him, a broken and miserable wreck. You may crush and hold in subjection for a time the external part of men, but you cannot govern and possess their soul. Their soul lies out of your reach, and is in its nature as ungovernable as the wind or the wave. You may trick and deceive it for a time; you may make it the instrument of its own slavery by cleverly arranged systems of conscription, and other governing devices; you may cast it into a deep sleep, but sooner or later it wakes, and rebels, and claims its own inheritance in itself. In the same way there is no such thing as what is called the self-government of a nation. How can you get self-government by turning one half of a nation into a second-hand copy of a Tsar? That, as Mill showed long ago, is not self-

government ; but government by others. It is true that here, as with the autocrat, a majority can for a season use for its own ends and oppress a minority, can do with it what in its heart it lusts to do, can make it the *corpus vile* of its experiments, can make of it a drawer of water and hewer of wood ; but it is only for a short day. Here again that uncompromising thing, the soul, stands in the way, and refuses to be transferred from the rightful to the wrongful owner. The power of the majority wanes, and the power of the minority grows, and the oppressor and the oppressed change places. But apart from all the deeper reasons that make the subjection of men by men impossible, was there ever such a hopeless, I might say absurd, bit of machinery—only to be compared to a child's attempt to put together a wooden clock out of the chippings left in the wood basket—as the thing which we call a representative system ? Invent all the ingenious plans that you like, but by no possibility can you represent a nation for governing purposes. The whole thing is a mere phrase. Let us see what actually happens. Suppose a nation with 5,000,000 voters—2,000,000 voting on one side, and 3,000,000 on the other. In such a case we start with the astounding, the absurd, the grotesque fact that there is no attempt made to represent the 2,000,000. Even if you had a system of minority representation, it might possibly serve in some small measure to soothe the feelings of the subject race ; it would not alter the hard fact of their subjection. But at present the 2,000,000 voters find no place of any kind in our calculations ; they are simply swept off the board, not counted. That is the first remarkable feature of the representative system ; and that, as you will admit, is not the happiest beginning with which to start. If representation con-

stitutes the moral basis of power—then the fact, that out of every five men two should be left unrepresented, requires a good deal of explanation; two-fifths of the moral basis at all events are wholly wanting. We are fond of talking of our representative system as if it rested on a democratic foundation; but under which of the three great democratic principles—equality, fraternity, liberty—does the sweeping off the board of two-fifths of the nation, the two men out of every five, find its sanction?

Let us, however, for the present leave the 2,000,000 voters to their fate. They are, as we have seen, only a subject race; and subject races must be duly reasonable, and not expect too great a share in the privileges of conquering races. Now let us turn to the case of the happy triumphant 3,000,000 voters, who hold in subjection the 2,000,000 voters. Are they themselves represented in any true sense? Let us see what happens to them—the majority, who are good enough for a time to take charge of all of us. Unlimited power means that our lords and masters of the moment may deal, that they will probably try to deal, with every, or almost every field of human activity. If there are—say—ten great State departments, such as trade, foreign affairs, local government, home government, and the rest; and if we suppose with due moderation that there are ten great questions connected with each of these departments, that may at any moment occupy the attention of our presiding majority, then we have a grand total of a hundred questions, upon which the opinions of the 3,000,000 electors will have to be represented. But alas! for our unfortunate and inconvenient human differences; how can the victorious 3,000,000 be represented on these hundred questions, when, if they think

at all, they will all think more or less differently from each other? To express fully their many differences, they ought to have nearly 3,000,000 representatives; but we will not ask for perfection; so let us divide the number by a hundred and say 30,000 representatives—an arrangement which, if the representatives met and talked for twenty hours every day in the year, would give, let us say, something over eight seconds of talking time for each representative during the course of the year as regards each of the hundred questions. When they had each talked their eight or nine seconds, how much real agreement should you expect to find among our 30,000 representatives on their hundred questions? Place twenty men in a room to discuss one subject; and how many different opinions will you collect at the end, if the twenty men are intelligent, and interested in the subject? Will you not probably find three or four groups of opinions, each group representing a more or less different view? Now bring the 30,000 representatives together, and require them to agree, not on one subject, but on a hundred important and often complicated subjects. Remember they *must* agree—they have no choice—that necessity of agreement overrides everything else, for otherwise they cannot act together; but then comes the question—what is their agreement—forced upon them by the practical necessity of acting together as one man—morally worth? Is is not a mere form, a mere mockery, a mere illusion? They must agree; and they do agree; for the continuance of the party system, the winning of power, the subjecting of their rivals—all this depends on their agreeing; but in what sort of fashion, by what kind of mental legerdemain, is their agreement reached? It can only be reached in one simple way—by a wholesale

system of self-effacement. The 30,000 individuals must be content on, say, ninety-five per cent. of the hundred questions, to have no opinions; or if they have opinions, to swallow ninety-five per cent. of their opinions at a gulp, and to play the convenient, if somewhat inglorious part of cyphers. Yet under our system it is this larger half of the nation, these 3,000,000 voters, who have undertaken the responsibility of thinking and acting for the nation, of deciding these hundred questions both for themselves and for the rest of us; and the only way of deciding left to them is to efface themselves, and have no opinions—a rather sad anti-climax, I am afraid, to some of our everyday rhetoric on the subject of representative systems. If we look closely we find that these systems only mean—that if we have no personal opinions, we can be represented, so far as it is possible or worth while to represent blank sheets of paper; if we have personal opinions, we can't be represented. The question then forces itself upon us, is it a bit of honest work, is it profitable, is it worth the trouble, to construct a huge machinery for the purpose of representing cyphers, who have no opinions; and when we have constructed our illusory, our make-believe machine, to go into the market-place, and therefrom deliver ourselves of speeches about the excellence of our self-governing system? Is it right and true to set up a moral responsibility on the part of those who profess to govern, that cannot by any possibility be turned into a reality; to ask half the nation to sit in the seat of universal judgement—there to take their part in what is and must be an only half disguised farce? Does it not tell us something of the true nature of power, when we find ourselves obliged to descend to tricks of this kind in order to possess and to use it?

Does it mend matters to say that under our system we choose the best man available, and leave the hundred questions for him to deal with? That is only our old friend, the autocrat, come back once more, with a democratic polish rubbed over his face to disguise and, as far as may be, to beautify his appearance. Our sin consists in the suppression of our own selves and our own opinions; and in one sense we fall lower than the slaves of the autocrat, for they are simply sinned against, but we take an active part in the sin against ourselves.

And now how does this suppression of ourselves come about? There must be some powerful motive acting upon us, to induce us to take our place cheerfully in such a poor sort of comedy. Men don't suppress themselves, except to gain something that they much desire. Let us be frank once more, and confess we are bribed into this self-suppression by our reckless desire for power, and our desire to use the power, when gained, for special interests of our own. The power that we seek to win is a hard taskmaster as regards its conditions, and exacts that humiliating price from us. We take our own bribe for giving up our opinions, and play the part of cyphers, and at the same time bribe those others who are to play their part with us; we ask no questions of our conscience, but go on to the political Exchange, and there with a light heart do the necessary selling and buying.

Now follow a little further this process of self-suppression, this process of making the cyphers. When you have once required of men to efface themselves and all the higher part of themselves, in order that they may act together, then follows that bargaining and juggling with the groups, of which I have already spoken. The disinterested opinions—95 per cent. of them, as we

calculated—have vanished, much in the same fashion as the 2,000,000 voters vanished; they are swept off the board, as things for which no place can be found, but which are only very much in the way of the real business in hand; and only a few leading self-interests—three or four perhaps—still remain. Now you may bind unbought men together, in the one and true way, by their opinions; but when they have no opinions you must find a cement of a coarser and more material kind. Having once turned men into cyphers, nothing remains but to treat them as cyphers. The great trick—the winning of power—requires cyphers, and can't be played in any other fashion. Having once turned men into cyphers, you must appeal to them as good loyal party followers; or you must appeal to them as likely to get more from you than from any other buyer in the market: you can't appeal to them—except in the imaginative moments when you are treading the flowery paths of rhetoric—as men, possessed of conscience, and will, and responsibility, for in that case they might once more regain possession of their suppressed consciences and their higher faculties, and begin to think and judge for themselves—a result that would have very inconvenient consequences; for then they would no longer agree to have one opinion on the hundred subjects; they would divide and scatter themselves in all sorts of directions; they would be a source of infinite trouble and vexation to the distracted party-managers; they would no longer be of use as fighting material; and the well-disciplined army would dissolve into an infinite number of separate and divergent fragments. No! as long as party faces party, and the great struggle for power goes on, the rank and file, however intelligent, however well-educated, must be content to think with

the party. They can't think for themselves, for if they did they would think differently; and if they thought differently, they could not act together; so they must be content to be just war-material, very like the masses of conscripts which foreign governments occasionally employ to hurl against each other. If they were anything else, it would be a very poor fighting show that our political parties would make on their battle-field. The great struggle for power would die out, would come naturally to its end, when the suppression of self and the making of the cyphers had ceased to be.

It is well to notice here that in some other countries you have not two political parties of the same definite character as with us, but a large number of groups. The fact of the groups very slightly affects the situation. Under every system the vices that go with the seeking for power return in pretty nearly the same form. The groups can't form a majority, and obtain power, unless they amalgamate; which means that each group has its market price, makes the best bargain that it can for itself, and for the sake of that bargain consents to act with, and so to increase the strength and influence of those with whom it may be in strong disagreement. Of course hopeless moral confusion arises from this temporary amalgamation of the odds and evens, and separate, unlike pieces, from this making of a common cause by those who mean different things, and are almost as much opposed to each other as they are to the common enemy, to whom for the moment they are opposed. Under no circumstances can we afford to depart from the great principle that we must never abandon our own personality, that we must only strive for the ends in which we ourselves believe, and never consent to enter into combinations, in which we either

are used against our convictions, or use others against their convictions. Whenever we descend to 'log rolling'—your services to pay for my services—we are lost in a sea of intrigue and corruption, and all true guidance disappears. There is no true guidance for any of us, except in our own best and highest selves, in our own personal sense of what is true and right. When that goes, there is little, if anything, worth the saving.

And now, passing by many incidents in the working of the great machine, that is so largely indulgent to our fighting and bargaining propensities, I come to what seems to me the very heart of Mr. Spencer's social and political teaching. It is not often given to a man to sum up in three words a great truth, that is fated sooner or later to revolutionize the thought and action of all nations; and yet that is, I think, what Mr. Spencer happily achieved. The three words were—'progress is difference'—that is, if you or I are to think more clearly, or to act more efficiently and more rightly than those who have preceded us, it can only be because at some point we leave the path which they followed, and enter a new path of our own—in other words, we must have the temper and courage to differ from accepted standards of thought and perception and action. If we are to improve in any direction, we must not be bound up with each other in inseparable bundles, we must have the power in ourselves to find and to take the new path of our own. Is not every improvement of machinery and method, every gain made in science and art, every choosing of the truer road and turning away from the false road that we have hitherto trodden—does it not all arise from those differences of thought and perception which, so long as freedom exists, even in its present imperfect forms, are from time to time born

amongst us? Whenever men become merely copies and echoes of each other, when they act and think according to fixed and sealed pattern, is not all growth arrested, all bettering of the world made difficult, if not impossible? What hope of real progress, when difference has almost ceased to exist; when men think in the same fashion as a regiment marches; and no mind feels the life-giving stimulating impulse which the varying competing thoughts of others brings with it? Do we not see in some parts of the East, when men are bound rigidly together under one system of thought, how difficult, how painful, the next upward step becomes; and when the change comes, how dissolvent and destructive it tends to be? Do we not see the same thing in Churches and States nearer home—the more that minds are uniformly subjected to one system, the more difficult becomes the adaptation of the old to the new, the more violent revolutionary and catastrophic the change when it takes place? Safety only lies in the constant differences which many living minds, looking from their own standpoint, in turn contribute. All unity, that exists by means of social or artificial restraint of differences, is slowly but inevitably moving towards its own destruction—a destruction that must finally involve much pain and confusion and disorder, because change and adaptation have been so long resisted.

Now if we accept this simple but most far-reaching truth—'progress is difference'—as I think we must do—let us frankly and loyally accept it with all the great consequences which follow from it. If progress is the child of difference, then it is for us to let our social and political systems favour difference to the fullest extent possible. At no point must we imprison minds under those fighting systems, which always

restrain thought and favour mechanical discipline—fighting is one thing and thinking is another; at no point must we stereotype action, preventing its natural and healthy divergence; at no point throw difficulties in the way of effort and experiment; at no point de-individualize men by making them dull repetitions of each other, soulless, automatic cyphers, lost, helpless in their crowd; but everywhere we must allow the natural rewards and inducements and motives to act upon free self-guiding men and women, encouraging them to feel that the work of improvement, the work of world-bettering, the achieving of progress, lies in their own hands, as individuals, and that, if they wish to share in this great common work, they must strive individually to live at their best. Throughout the whole nation, we must let every man and woman, instead of looking to their parties and parliaments and governments, feel the full strength of the inspiring inducement to do something in their own individual capacities and to join with others in doing something—the smallest or the greatest thing—better than it has yet been done, and so make their own contribution to the great fund of general good. Only so can the far-reaching powers which lie in human nature, but which, like the talent, are so often wrapped in the napkin, hidden and unused, find their full scope and development; only so can our aims and ambitions be ennobled and purified; only so can the true respect for the individuality of others soften the strife of opinions, and the intolerant spirit in which we so often look upon all that is opposed to and different from ourselves. As we recognize and respect the individuality both of ourselves and others; as we realize that the bettering of the world depends upon our individual actions and

perceptions; that this bettering can only be done by ourselves, acting together in free combination; that it depends upon the efforts of countless individuals, as the rain-drops make the streams, and the streams make the rivers, that it cannot be done for us by proxy, cannot be relegated, in our present indolent fashion, to systems of machinery, or handed over to an army of autocratic officials to do for us; and as we realize that we shall have failed in our part, have lived almost in vain, if in some direction, in some department of thought or action—whatever it may be—we have not individually striven to make the better take the place of the good; life will become for all of us a better and nobler thing, with more definite aims, and greater incentives to useful action. The work that we do will react on ourselves; and we shall react on the work. Each victory gained, each new thing well done will make the men, the fighters for progress; and as the fighters are raised to a higher capacity, the progress made will advance with bolder, swifter strides, invading in turn every highway and by-way of life. But this healthy reaction cannot be as long as we live under the depressing and dispiriting influence of the great machines, that take the work out of our hands, and encourage in us all a sense of personal uselessness. The appeal must be straight and direct to the individuals, to their own self-direction, their own self-sacrifice, to their own efforts in free unregulated combinations, their own willing gifts and services.

It is in vain that you will ask for the progress, that is born in the conflict of competing thoughts and perceptions, from the great official departments, into whose hands you now so complacently resign yourself. They are incapacitated as instruments of progress by

the law of their own being. Whenever you act and think wholesale, and in authoritative fashion for others, you become to a certain extent limited and incapacitated in your own nature. That mental penalty for ever dogs the possession of power. You lose sight of the great and vital ends, and allow the small things to change places with the all-important things. You are no more in touch with the living forces that make for progress. Why? Are the reasons far to seek? The body of officials—however good and honourable in themselves—form a caste, that administers the administered, and does not really share in the actual life of the nation; the chiefs, intent upon the huge machine, which they direct from behind their office windows; the large body, dutifully following their traditions, and clinging to their precedents. They are cut off from all the great inspirations, for the great inspirations are only likely to come to those who share in the active throbbing life that is not found in any one part, but in the whole, of a free nation, and that exists, as we have seen, as the sum of countless differing contributions. The best inspirations only readily come to those who live open to all influences, who are not narrowed and limited by that sense of slightly contemptuous superiority, which we all—however excellent we may be—are apt to feel when we are treating others as passive material under our hands. I doubt if you can ever impose your own will by means of force on others, without acquiring in yourself something of this superior scorn. But this scorn is fatal to the great inspirations, for they are only born in us when we are in truest personal sympathy with the upward movement, whatever it may be, when we ourselves are part of it, when we are thinking and feeling freely, and are surrounded by those thinking

and feeling like ourselves, for in real free life we are for ever giving and receiving, absorbing and radiating. There and there only do you get the true soil-bed of progress. Nor, if our official classes were willing to be helped by the thought of others, is it possible. Under their authoritative systems they have made the people helpless, apathetic, indifferent; and so have to carry the great burden of thinking for a nation on their own shoulders alone. Few people really think or perceive, who can give no practical effect to their thoughts and perceptions; and so it is that we see administered nations grow first indifferent, and then revolutionary. It is thus, in this vicious circle, that bureaucracy ever works. Our bureaucrats, with their universal systems, paralyse and benumb the best thought and energies of the nation; and then themselves are mentally starved in the dead-alive condition of things that they have created. Then again our official classes are not only, like the autocrat, controlled and disabled by their own machinery, but they fall—who could help it?—under the drowsy influence of the ever revolving wheels. The habit of doing the one thing in the same fixed way depresses the brighter faculties, and the *vis inertiae* becomes the paramount force. The machinery, on which everything depends, takes the first place; its moral and spiritual effect upon the people take the second or third place, or no place at all. Thus it is that every huge administrative system tends to that barren uniformity which is a kind of intellectual death, and from which that essential element of progress—experiment, is necessarily absent. When you have constructed a universal system, embracing the whole nation, you can't experiment. The thousands of wheels must all follow each other in the same track

with undeviating uniformity. Even if your official feelings would allow of such an unorthodox proceeding, it is mechanically very difficult to interfere with the regularity and precision that make the working of universal systems possible. And so it happens that not only is a man with new ideas a real terror inside the walls of a great department, but that there are two phases that succeed each other in turn in the life of these departments. There is the period of somnolence, the mechanical repetition of what had been said and done in past years, the same sending out of the old time-honoured forms, the same pigeon-holing of the answers, the same holding of inspections, the same administering of the nation by the junior clerks; and with it all, complete insensibility as to what influence the system as a whole is exercising on the soul of the people. The daily thought and care of a good official begins and ends with taking precautions that the system, as a system, is working smoothly and without friction. As to what the system is in itself, it is not his province to think, and he very rarely does think. He did not create it; he is not directly responsible for it—as a rule nobody knows who is responsible for it—his work is simply to make the countless wheels duly follow each other with regularity and precision. That somnolent period, however, only lasts for a time; presently comes the revolutionary period of remorselessly pulling down and then building up in haste—a period in which the department suddenly awakes from its sleep—aroused perhaps by some external impulse, perhaps by the truer perceptions, or perhaps by the wayward fancies of some Minister, fresh to office, who longs to inaugurate his own little revolution. Then the sleepers become changed into reformers;

and suddenly we are authoritatively assured that we have been following altogether wrong methods, that the old system, under which serious evils have been growing up, must be at once transformed into something of a new and very different order. The nation, dully and dimly aware that things are not as they should be, smiles approvingly, and through its press, faintly applauds; and the plant, perhaps of some twenty years' growth, is straightway torn up by the roots—a fate which after a few years will be again shared by the new thing that now takes its place. It is not the fault of the officials. If you or I were in their place we should be just as somnolent, and just as revolutionary. The fault lies in the great system itself; and few of us could resist the spell that it exercises. The truth is that you can no more administer a whole nation than you can represent it. You cannot deal with human nature wholesale; you cannot throw it higgledy piggledy into one common lot, and let half a dozen men, no better or worse than ourselves, take charge of it. No universal system is a living thing: they all tend to become mere machines—machines of a rather perverse kind, that have incurable tricks of going their own way. We are apt to think that our machines dutifully serve and obey us; but in large measure we serve and obey them. They too have souls of their own, and command as well as obey. Unfortunately for us, progress and improvement are not amongst the things that great machines are able to supply at demand. Their soul lies in mechanical repetition, not in difference; whilst progress requires not only faculties in the highest state of vital activity, but I might almost say continual, mental dissatisfaction with what has been already achieved, and continual preparedness

to invade new territory and attempt new victories. Progress depends upon a great number of small changes and adaptations and experiments, constantly taking place—each carried out by those who have strong beliefs and clear perceptions of their own in the matter; for the only true experimenter is he who finds and follows his own way, and is free to try his experiment from day to day. But this true experimentation is impossible under universal systems. An experiment can only be tried on a small scale by those who are the clearer-sighted amongst us, and are aiming at some particular end, and when those who are affected by it are willing to take the risk. You can't rightly experiment with a whole nation; and the consequence is that the sin and mistakes of every universal system go on silently accumulating, until the time comes for the next periodical tearing up by the roots of what exists comes due, and once more we start afresh.

And now there are still many other points on which I must not touch to-day. There is that great subject of excessive public expenditure in all countries, which is like a tide which flows and flows and hardly ever ebbs. A few years ago when some of us began to preach voluntary taxation, as the only effectual means of recovering the gradually disappearing independence of the individual, and of placing governments in their true position of agents, and not, as they are to-day, of autocrats and masters of the nation, and as the plainest and most direct means of making the recognition of the principle of individual liberty supreme in our national life, I found most of my friends quite content to be used as tax-material, even though the sums of money taken from them were employed against their own beliefs and

interests. They had lived so long under the system of using others, and then in their turn being used by them, that they were like hypnotized subjects, and looked on this subjecting and using of each other as a part of the necessary and even Providential order of things. The great machine had taken possession of their souls; and they only yawned and looked bored, or slightly scornful at any idea of rebelling against it. In vain we drew the picture of the nobler, happier, safer life of the nation, when men of all conditions voluntarily combined to undertake the great services, class co-operating with class, each bound to the other by new ties of friendship and kindliness, with all its different groups learning to discover their own special wants, to follow their own methods, and make their own experiments. In that way only, as we urged, could we replace the present dangerous and mischief-making strife with blessed fruitful peace, create a happier, better, nobler spirit amongst us all, destroy the old traffic and bargaining of the political market, destroy the fatal belief that one class might rightly prey upon another class, and that all property finally belonged to those who could collect the greater number of votes at the polls. That belief in the omnipotent vote, as we urged, was striking its roots deeper every year—it was the certain, the inevitable result of our party fighting for the possession of power. So long as the vote carried with it the unlimited undefined power of the majority, the giving away of property must always remain as the easiest means of purchasing the owners of the vote; and that belief in the final ownership of property being vested in the voter we could only fight, not by resisting here or there, not by denouncing this or that bit of excessive and wasteful expenditure,

but by challenging the rightfulness and good sense of the whole system, by pointing to a truer, nobler, social life, and by resolutely standing on the plain broad principle of individual control over ourselves and our own property. It was in friendly voluntary co-operation, as free men and women, for all public wants and services; in taking each other's hands, in sharing our efforts; it was by destroying the belief in power, the belief in 'pooling' property and faculties, the belief in the false right of some men to hold other men in subjection, and to use them as their material; in building up the belief in the true rights, the rights of self-ownership and self-guidance, apart from which everything tends to the confusion and corruption of public life—it was only so that we could ward off the coming danger and the inevitable strife. These great national services, that we had so lightly flung into the hands of our officials, were the true means of creating that higher and better national life, with its friendly inter-dependence, its need of each other, its respect for each other, which was worth over and over again all the political gifts and compulsions—though you piled them up in a heap as high as Pelion thrown on the top of Ossa. It was only so that the nation would find its true peace and happiness, and that the smouldering dread and hatred of each other could die out. The years have passed; and I think a change of mood has silently come over many persons. I find that some of those who once clung to compulsion as the saving social bond, as the natural expression of national life, are willing to-day to consider whether some better and truer and safer principle may not be found; are willing to consider, as a practical question, if some limit should not be placed on the power to take and to spend in

unmeasured quantity the money of others. Our friend the Socialist has done, and is doing for us his excellent and instructive work. He stands as a very striking—I might say eloquent landmark, showing us plainly enough where our present path leads, and what is the logical completion of our compulsory interferences, our restrictions of faculties, and our transfer of property by the easy—shall I say by the laughable and grotesque—process of the vote? Into our present system, which so many men accept without thinking of its real meaning, and its further consequences, he introduces an order, a consistency, a completeness of his own. His logic is irresistible. If you can vote away half the yearly value of property under the form of a rate, as we do in some towns at present, then under the same convenient and elastic right you can vote away the nine-tenths or the whole. '*Only* logic' perhaps you lightly answer—but remember, unless you change the direction of the forces, logic always tends to come out victorious in the end. Let us then take the bolder, the truer, the more manful course. If we believe in property, as a right and just thing, if, as the product of faculties, we believe it to be inseparably connected with the free use of faculties, and therefore inseparably connected with freedom itself; if we believe that it is a mere bit of word-mockery to tell us—as our Socialist friends do—that they are presenting the world with the newest, the most perfect, the most up-to-date form of liberty, whilst from their heights of scorn for liberty they calmly deny to every man and woman the right to employ their faculties in their own way and for their own advantages, offering us in return a system beyond all words petty and irritating, a system that would provoke rebellion even in the nursery, and which, as a clever French

writer wittily remarked, would periodically convulse the State—with the ever-recurring insoluble question—might or might not a wife mend the trousers of her husband; if we believe that the Socialist, treading in the footsteps of his predecessor, the autocrat, has only discovered one more impossible system of slavery, then let us individually do our best to end the great delusion—that has given birth to the Socialist, and made him the power that he is to-day in Europe—that property belongs, not to the property-owner, but to those who are good enough to take the trouble to vote. Don't let us play any longer with these dangerous forces, which, if they win, will for a time wholly change the course of human civilisation; and above all don't let us put it in the power of the voter to turn round some future day and say to us—'As long as it served your interests and ambitions, you acknowledged the supremacy of the vote; you acknowledged this right of taking property from each other. You taught us, you sanctioned, through many years, the principle of unlimited power, vested in some men over other men. Is it not now a little late in the day for you suddenly to cry 'halt' in the path along which you have so long led us, because you see new interests and ambitions taking their place by the side of your own discredited interests and ambitions, which are no longer able to satisfy the heart of the nation? If the old game was good enough and right enough in your hands, when you were our leaders, so is the new game right and good enough in our hands, now that it is our turn to lead.' What true, what sufficient answer would there remain for us to make? Were it not better to repent of our past sins to-day, whilst there is yet time and opportunity to do something to repair them? If we are only to begin to quarrel

with power and its consequences when we find that it has already slipped away from our hands, shall we not be too much like the grey-haired sinner who turns saint in that sad period when the pleasures of life have already ceased to exist for him? Better to repent whilst there is still something to sacrifice and renounce; and we can still give some proof that our repentance is the child of real conviction.

Let us try to clear our thoughts, and know our own minds in this great matter. Do we or do we not mean to consent to that final act in the long drama which is euphemistically called 'the nationalizing of property'? If we do not mean to consent to that last crowning act of the process of voting away the property of each other, then it is not only an unworthy weakness on our part, but a cruel wrong to encourage by our words and actions in the mass of the people a belief, which some day, when it grows to its full strength and height, we shall scornfully—whatever our scorn may then avail—disown and reject, forgetting with our changed attitude how we once planted that belief in their hearts, used it, and played with it for the sake of our ambition and our desire to possess power. When the great bitter strife comes—as it must come—shall we not be constrained with shame to accuse ourselves, and to acknowledge our misleading of the people, our responsibility in the past for the infinite calamities we have brought both upon them and upon ourselves. Do not let us wait for that future so fraught with evil, which our own carelessness of thought, our disregard of the great principles, our love of the wildly exciting political game, and our subservience to party interests are preparing for us. The hours of the day are not yet spent. The temper of our people is a noble generous temper, if you appeal to

it in the true way, appealing for right's sake, for principle's sake, not merely for the sake of class or party or personal interests, not merely for the sake of the many pleasant things that belong to the possession of property. Let us make some sacrifice of our political ambitions, and take our stand on the truest, highest ground. Our task is to make it clear to the whole nation that a great principle, that which involves the free use of faculties, the independence of every life, the self-guidance and self-ownership, the very manhood of all of us, that commands and constrains us to preserve the inviolability of property for all its owners—whoever they may be. The inviolability of property is not simply the material interest of one class who happen to-day to possess it, it is the supreme interest of all classes. True material prosperity can only be won by the great body of the nation through the widest measure of liberty—not the half-and-half, not the mock system, that exists at present. Create the largest and most generous system of liberty, create—as you will do with it—the vital energizing spirit of liberty, and in a few short years the working classes would cease to be the propertyless class; would become with their great natural qualities the largest property-owner in the country. But this can only be, as they set themselves in earnest to *make* property instead of *taking* it, and to put the irresistible pence and shillings together for the carrying out of all the great services. This in truth was the splendid campaign on which he had entered, when the politician, sometimes hungering to play the important part, and to exalt his small restless self, sometimes misled by nobler dreams, drew his deluding herring across the path, and pointed to the easier downhill way of the common fund and the all-powerful vote.

It is the politician with his cheap liberality and his giving away of what does not belong to him, who perpetuates the depressed and unprogressive condition of a large part of the people; he is only too much like those who nurse poverty by their careless and misplaced charity. He stands in the way of the true efforts of the people, of their friendly co-operation, their discovery of all that they could achieve for their own happiness and prosperity, if they acted together in their free self-helping groups. Let us never forget the power of the accumulated pence. If we could persuade a million men and women to lay aside one halfpenny a week, at the end of a year they would have over £100,000 to invest in farms, houses, recreation grounds, in all that they felt they most needed. With the acquisition of property would come many of the helpful and useful qualities—the self-confidence, the faculty of working together, and of managing property, and the proud inspiring ambition to remake in peaceful ways, unstained by any kind of violence, and therefore challenging and encountering no opposing forces, the whole condition of society, as it exists to-day. Such is the goal to which we, who disbelieve in force, must ever point the way. It is for us to show that everything can be gained by voluntary effort and combination, and nothing can be permanently and securely gained by force. In every form, where men hold men in subjection to themselves, force is always organized against itself, is always tending sooner or later to destroy itself. Autocrat, restless politician, or Socialist, they are all only labourers in vain. There is a moral gravitation that in its own time drags all their work remorsely to the ground. Everywhere, across that work, failure is written large. There are many reasons. In the first

place, force begets force, and dies by the hand of its own offspring; then those who use force never act long together, for the force-temper leads them to turn their hand against each other; then the continued use of force, as is natural, develops a superhuman stupidity, a failure to see the real meaning and drift of things, in thos who use it; but greatest of all reasons, the soul of man is made for freedom, and only in freedom finds its true life and development. So long as we suppress that true life of the soul, so long as we deny to it the full measure of its freedom, we shall continue to strive and to quarrel and to hate, and to waste our efforts, as we have done through so many countless years, and shall never enter the fruitful path of peace and friendship that waits for us. Once show the people, make it clear to their heart and understanding, that it is liberty alone that can lead us into this blessed path of peace and friendship; that it alone can still the strife and the hatreds; that it alone is the instrument of progress of every kind; that it alone in any true sense can make and hold together and preserve a nation—which, if it rejects liberty, must in the end tear itself to pieces in the great hopeless aimless strife—once show them this supreme truth, feeling it yourself in the very depths of your heart, and so speak to them—and then you will find, as you touch the nobler, more generous part of their nature, that gradually, under the influence of the truer teaching, they will learn to throw aside the false bribes and mischievous attractions of power, and to turn away in disgust from that mad destructive game in which they and we alike have allowed ourselves for a time to be entangled. It is not the Socialist party, it is not any of the Labour parties who have done the most to lead astray the people, and to teach them to

believe that political power is the rightful instrument for securing all that their heart desires. These extreme parties have simply trodden more boldly the path in which we went before them. They have only been the pupils—the too apt pupils—in our school, who have bettered our own teaching. It is we, the richer classes, who in our love of power, our desire to win the great game, have done the great wrong, have misled and corrupted the people; and the fault and the blame and the shame will rest in the largest measure with us, when the evil fruit grows from the seed that we so recklessly planted. When the chickens come home to roost, we shall only have to say, as so many have said before us—*tu l'as voulu, Georges Dandin*. Let us then, who have made the great mistake, let us try to redeem it; let us show the people that there is a nobler, happier form of life than to live as two scrambling, quarrelling crowds, mad for their own immediate interests, void of all scruple or restraint. Let us shake ourselves free from this miserable party fighting; let us speak only in the name of the great rights, the great all-guiding, ever-enduring principles; let us oppose the power of some men over other men, as a thing that is in itself morally untrue, untrue from every higher point of view, that is *lèse-majesté* as regards all the best and noblest conceptions of what we are—beings gifted with free responsible souls—as the source of hopeless confusion and scramble and injustice; and let us steadfastly set our faces towards the one great ideal of making a nation, in which all men and women will love their own liberty—without which life is as salt that has lost its savour, and is only fit to be cast away—as deeply as they respect and seek to preserve the liberty of others.

A few words to prevent a possible misunderstanding.

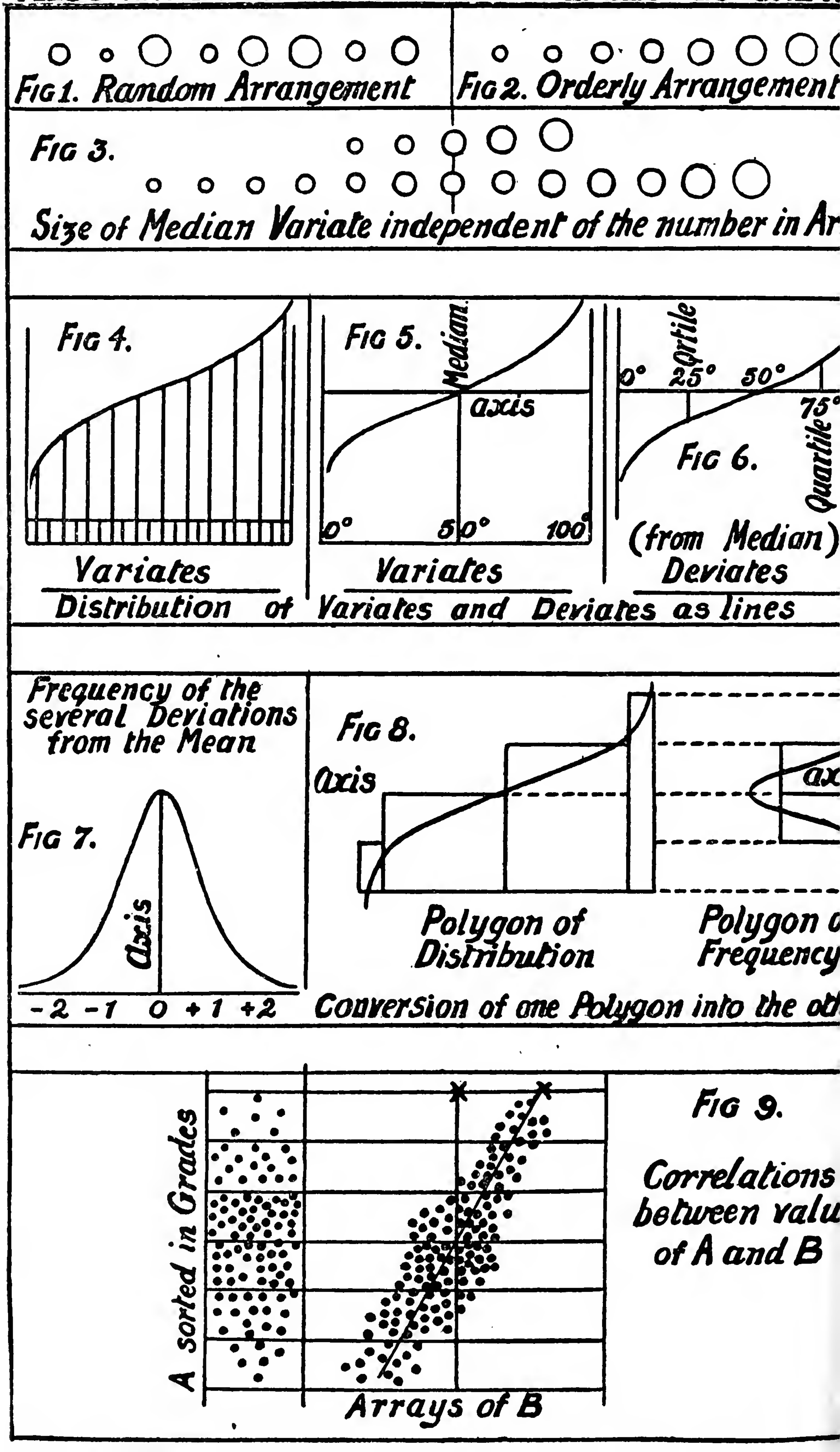
I have not been preaching any form of Anarchy, which seems to me—even in its most peaceful and reasonable forms—quite apart from the detestable bomb—merely one more creed of force (I am not referring here to such a form of Anarchy—passive resistance under all circumstances—as Tolstoy preaches, into the consideration of which I cannot enter to-day). Anarchy is a creed, which, as I believe, we can never rightly class among the creeds of liberty. Only in condemning Anarchy we shall do well to remember that, like Socialism, it is the direct product, the true child of those systems of government that have taught men to believe that they may rightly found their relations to each other on the employment of force. Both the Anarchist and the Socialist find some measure of justification in the practice and teaching of all our modern governments, for if force is a right thing in itself, then it becomes merely a secondary question—on which we may all differ—as to the quantity and quality of it to be employed, the purposes for which we may use it, or in what hands the employment of it should be placed. There is, there can be, nothing sacred in the division of ourselves into majorities and minorities. You may think right to take only half a man's property from him by force; I may prefer to take the whole. You may think right to entrust the use of force to every three men out of five; I may prefer to entrust it—as the Anarchist does—to each one of the five separately; or as some Russians and some Germans do, to the autocrat or half-autocrat, and his all-embracing bureaucracy. Who shall decide between us? There is no moral tribunal before which you can summon unlimited power, for it acknowledges, as we have seen, nothing higher than itself; if it did acknowledge any moral law above itself,

its wings would be clipped, and its nature changed, and it would no longer be unlimited.

Now glance for a moment at the true character of Anarchy, and see why we must refuse to class it among the creeds of liberty, though many of the reasonable Anarchists are inspired, as I believe, by a real love of liberty. Under Anarchy, if there were 5,000,000 men and women in a country, there would be 5,000,000 little governments, each acting in its own case as council, witness, judge, and executioner. That would be simply a carnival, a pandemonium of force; and hardly an improvement even upon our power-loving, force-using governments. Force, as I believe, with Mr. Spencer, must rest, not in the hands of the individual, but in the hands of a government—not to be, as at present, an instrument of subjecting the two men to the three men, not to be exalted into the supreme thing, lifted up above the will and conscience of the individual, judging all things in the light of its own interests, but strictly as the agent, the humble servant of universal liberty, with its simple duties plainly, definitely, distinctly marked out for it. Our great purpose is to get rid of force, to banish it wholly from our dealings with each other, to give it notice to quit from this changed world of ours; but as long as some men—like Bill Sykes and all his tribe—are willing to make use of it for their own ends, or to make use of fraud, which is only force in disguise, wearing a mask, and evading our consent, just as force with violence openly disregards it—so long we must use *force to restrain force.* That is the one and only one rightful employment of force—force in the defence of the plain simple rights of liberty, of the exercise of faculties, and therefore of the rights of property, public or private, in a word of all the rights of self-ownership

—force used defensively against force used aggressively. The only true use of force is for the destruction, the annihilation of itself, to rid the world of its own mischief-making existence. Even when used defensively, it still remains an evil, only to be tolerated in order to get rid of the greater evil. It is the one thing in the world to be bound down with chains, to be treated as a slave, and only as a slave, that must always act under command of something better and higher than itself. Wherever and whenever we use it, we must surround it with the most stringent limits, looking on it, as we should look on a wild and dangerous beast, to which we deny all will and free movement of its own. It is one of the few things in our world to which liberty must be for ever denied. Within those limits the force, that keeps a clear and open field for every effort and enterprise of human activity—that are in themselves untainted by force and fraud—such force is in our present world a necessary and useful servant, like the fire which burns in the fireplaces of our rooms and the ranges of our kitchen; force, which once it passes beyond that purely defensive office, becomes our worst, our most dangerous enemy, like the fire which escapes from our fireplaces and takes its own wild course. If then we are wise and clear-seeing, we shall keep the fire in the fireplace, and never allow it to pass away from our control.

ILLUSTRATIONS OF THE HERBERT SPENCER LECTURE I



Probability, the Foundation of Eugenics

THE HERBERT SPENCER LECTURE

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PROBABILITY, THE FOUNDATION OF EUGENICS

THE request so honourable to myself, to be the Herbert Spencer lecturer of this year, aroused a multitude of vivid recollections. Spencer's strong personality, his complete devotion to a self-imposed and life-long task, together with rare gleams of tenderness visible amidst a wilderness of abstract thought, have left a unique impression on my mind that years fail to weaken.

I do not propose to speak of his writings; they have been fully commented on elsewhere, but I desire to acknowledge my personal debt to him, which is large. It lies in what I gained through his readiness to discuss any ideas I happened to be full of at the time, with quick sympathy and keen criticism. It was his custom for many afternoons to spend an hour or two of rest in the old smoking room of the Athenaeum Club, strolling into an adjoining compartment for a game of billiards when the table was free. Day after day on those afternoons I enjoyed brief talks with him, which were often of exceptional interest to myself. All that kind of comfort and pleasure has long ago passed from

me. Among the many things of which age deprives us, I regret few more than the loss of contemporaries. When I was young I felt diffident in the presence of my seniors, partly owing to a sense that the ideas of the young cannot be in complete sympathy with those of the old. Now that I myself am old it seems to me that my much younger friends keenly perceive the same difference, and I lose much of that outspoken criticism which is an invaluable help to all who investigate.

History of Eugenics.

It must have surprised you as it did myself to find the new word 'Eugenics' in the title both of the Boyle lecture, delivered in Oxford about a fortnight ago, and of this. It was an accident, not a deliberate concurrence, and I accept it as a happy omen. The field of Eugenics is so wide that there is no need for myself, the second lecturer, to plant my feet in the footsteps of the first; on the contrary, it gives freedom by absolving me from saying much that had to be said in one way or another. I fully concur in the views so ably presented by my friend and co-adjutor Professor Karl Pearson, and am glad to be dispensed from further allusion to subjects that formed a large portion of his lecture, on which he is a far better guide and an infinitely higher authority than myself.

In giving the following sketch of the history of Eugenics I am obliged to be egotistical, because I

kindled the feeble flame that struggled doubtfully for a time until it caught hold of adjacent stores of suitable material, and became a brisk fire, burning freely by itself, and again because I have had much to do with its progress quite recently.

The word 'Eugenics' was coined and used by me in my book *Human Faculty*, published as long ago as 1883, which has long been out of print; it is, however, soon to be re-published in a cheap form. In it I emphasized the essential brotherhood of mankind, heredity being to my mind a very real thing; also the belief that we are born to act, and not to wait for help like able-bodied idlers, whining for doles. Individuals appear to me as finite detachments from an infinite ocean of being, temporarily endowed with executive powers. This is the only answer I can give to myself in reply to the perpetually recurring questions of 'Why? whence? and whither?' The immediate 'whither?' does not seem wholly dark, as some little information may be gleaned concerning the direction in which Nature, so far as we know of it, is now moving. Namely towards the evolution of mind, body, and character in increasing energy and co-adaptation.

I have often wondered that the poem of Hyperion, by Keats—that magnificent torso of an incompleted work—has not been placed in the very forefront of past speculations on evolution. Keats is so thorough that he makes the very Divinities to be its product. The earliest gods such as Coelus, born out of Chaos,

are vague entities, they engender Saturn, Oceanus, Hyperion, and the Titan brood, who supersede them. These in their turn are ousted from dominion by their own issue, the Olympian Gods. A notable advance occurs at each successive stage in the quality of the Divinities. When Hyperion, newly terrified by signs of impending overthrow, lies prostrate on the earth 'his ancient mother, for some comfort yet,' the voice of Coelus from the universal space, thus 'whispered low and solemn in his ear . . . yet do thou strive for thou art capable . . . my life is but the life of winds and tides, no more than winds and tides can I prevail, but thou canst.' I have quoted only disjointed fragments of this wonderful poem, enough to serve as a reminder to those who know it, but will add ten consecutive lines from the speech of the fallen Oceanus to his comrades, which give a summary of evolution as here described:

As Heaven and Earth are fairer, fairer far
Than Chaos and black Darkness, though once chiefs,
And as we show beyond that Heaven and Earth
In form and shape compact and beautiful,
In Will, in action free, companionship,
And thousand other signs of purer life;
So on our heels a fresh perfection treads
A power more strong in beauty, born of us
And fated to excel us, as we pass
In glory that old Darkness.

He ends with 'this is the truth, and let it be your balm.' The poem is a noble conception, founded on the crude cosmogony of the ancient Greeks.

The ideas have long held my fancy that we men may be the chief, and perhaps the only executives on earth. That we are detached on active service with, it may be only illusory, powers of free-will. Also that we are in some way accountable for our success or failure to further certain obscure ends, to be guessed as best we can. That though our instructions are obscure they are sufficiently clear to justify our interference with the pitiless course of Nature, whenever it seems possible to attain the goal towards which it moves, by gentler and kindlier ways. I expressed these views as forcibly as I then could in the above-mentioned book, with especial reference to improving the racial qualities of mankind, in which the truest piety seems to me to reside in taking action, and not in submissive acquiescence to the routine of Nature. It was thought impious at one time to attach lightning conductors to churches, as showing a want of trust in the tutelary care of the Deity to whom they were dedicated; now I think most persons would be inclined to apply some contemptuous epithet to such as obstinately refused, on those grounds, to erect them.

The direct pursuit of studies in Eugenics, as to what could practically be done, and the amount of change in racial qualities that could reasonably be anticipated, did not at first attract investigators. The idea of effecting an improvement in that direction was too much in advance of the march of popular imagination, so I had to wait. In the meantime I occupied myself with collateral problems, more especially with that of dealing

measurably with faculties that are variously distributed in a large population. The results were published in my 'Natural Inheritance' in 1889, and I shall have occasion to utilize some of them later on, in this very lecture. The publication of that book proved to be more timely than the former. The methods were greatly elaborated by Professor Karl Pearson, and applied by him to Biometry. Professor Weldon of this University, whose untimely death is widely deplored, aided powerfully. A new science was thus created primarily on behalf of Biometry, but equally applicable to Eugenics, because their provinces overlap.

The publication of *Biometrika*, in which I took little more than a nominal part, appeared in 1901.

Being myself appointed Huxley Lecturer before the Anthropological Institute in 1901 I took for my title 'The possible improvement of the Human Breed under the existing conditions of Law and Sentiment' (*Nature*, November 1, 1901, *Report of the Smithsonian Institute, Washington*, for the same year).

The next and a very important step towards Eugenics was made by Professor Karl Pearson in his Huxley lecture of 1903 entitled 'The Laws of Inheritance in Man' (*Biometrika*, vol. iii). It contains a most valuable compendium of work achieved and of objects in view; also the following passage (p. 159), which is preceded by forcible reasons for his conclusions:

We are ceasing as a nation to breed intelligence as we did fifty to a hundred years ago. The mentally

better stock in the nation is not reproducing itself at the same rate as it did of old; the less able, and the less energetic are more fertile than the better stocks. No scheme of wider or more thorough education will bring up, in the scale of intelligence, hereditary weakness to the level of hereditary strength. The only remedy, if one be possible at all, is to alter the relative fertility of the good and the bad stocks in the community.

Again in 1904, having been asked by the newly-formed Sociological Society to contribute a memoir, I did so on 'Eugenics, its definition, aim, and scope'. This was followed up in 1905 by three memoirs, 'Restrictions in Marriage,' 'Studies in National Eugenics,' and 'Eugenics as a factor in Religion', which were published in the Memoirs of that Society with comments thereon by more than twenty different authorities (*Sociological Papers*, published for the Sociological Society (Macmillan), vols. i and ii). The subject of Eugenics being thus formally launched, and the time appearing ripe, I offered a small endowment to the University of London to found a Research Fellowship on its behalf. The offer was cordially accepted, so Eugenics gained the recognition of its importance by the University of London, and a home for its study in University College. Mr. Edgar Schuster, of this University, became Research Fellow in 1905, and I am much indebted to his care in nurturing the young undertaking and for the memoirs he has contributed, part of which must remain for a short time longer unpublished.

When the date for Mr. Schuster's retirement approached it was advisable to utilize the experience so far gained in reorganizing the Office. Professor Pearson and myself, in consultation with the authorities of the University of London, elaborated a scheme at the beginning of this year, which is a decided advance, and shows every sign of vitality and endurance. Mr. David Heron, a Mathematical Scholar of St. Andrews, is now a Research Fellow; Miss Ethel Elderton, who has done excellent and expert work from the beginning, is deservedly raised to the position of Research Scholar; and the partial services of a trained Computer have been secured. An event of the highest importance to the future of the Office is that Professor Karl Pearson has undertaken, at my urgent request, that general supervision of its work which advancing age and infirmities preclude me from giving. He will, I trust, treat it much as an *annexe* to his adjacent biometric laboratory, for many studies in Eugenics might, with equal propriety, be carried on in either of them, and the same methods of precise analysis which are due to the mathematical skill and untiring energy of Professor Pearson are used in both. The Office now bears the name of the Eugenics Laboratory, and its temporary home is in 88 Gower Street. The phrase 'National Eugenics' is defined as 'the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally'.

The Laboratory has already begun to publish memoirs on its own account, and I now rest satisfied in the belief that, with a fair share of good luck, this young Institution will prosper and grow into an important centre of research.

Application of Theories of Probability to Eugenics.

Eugenics seeks for quantitative results. It is not contented with such vague words as 'much' or 'little', but endeavours to determine 'how much' or 'how little' in precise and trustworthy figures. A simple example will show the importance of this. Let us suppose a class of persons, called *A*, who are afflicted with some form and some specified degree of degeneracy, as inferred from personal observations, and from family history, and let class *B* consist of the offspring of *A*. We already know only too well that when the grade of *A* is very low, that of the average *B* will be below par and mischievous to the community, but how mischievous will it probably be? This question is of a familiar kind, easily to be answered when a sufficiency of facts have been collected. But a second question arises, What will be the trustworthiness of the forecast derived from averages when it is applied to individuals? This is a kind of question that is not familiar, and rarely taken into account, although it too could be answered easily as follows. The average mischief done by each *B* individual to the community may for

brevity be called M: the mischiefs done by the several individuals differ more or less from M by amounts whose average may be called D. In other words D is the average amount of the individual deviations from M. D thus becomes the measure of untrustworthiness. The smaller D is, the more precise the forecast, and the stronger the justification for taking such drastic measures against the propagation of class B as would be consonant to the feelings if the forecast were known to be infallible. On the other hand, a large D signifies a corresponding degree of uncertainty, and a risk that might be faced without reproach through a sentiment akin to that expressed in the maxim 'It is better that many guilty should escape than that one innocent person should suffer'. But that is not the sentiment by which natural selection is guided, and it is dangerous to yield far to it.

There can be no doubt that a thorough investigation of the kind described, even if confined to a single grade and to a single form of degeneracy, would be a serious undertaking. Masses of trustworthy material must be collected, usually with great difficulty, and be afterwards treated with skill and labour by methods that few at present are competent to employ. An extended investigation into the good or evil done to the state by the offspring of many different classes of persons, some of civic value, others the reverse, implies a huge volume of work sufficient to occupy Eugenics laboratories for an indefinite time.

Object Lessons in the Methods of Biometry.

I propose now to speak of those fundamental principles of the laws of Probability that are chiefly concerned in the newer methods of Biometry, and consequently of Eugenics. Most persons of ordinary education seem to know nothing about them, not even understanding their technical terms, much less appreciating the cogency of their results. This popular ignorance so obstructs the path of Eugenics that I venture to tax your attention by proposing a method of partly dispelling it. Let me first say that no one can be more conscious than myself of the large amount of study that is required to qualify a man to deal adequately with the mathematical methods of Biometry, or that any man can hope for much success in that direction unless he is possessed of appropriate faculties and a strong brain. On the other hand, I hold an opinion likely at first sight to scandalize biometricians and which I must justify, that the fundamental ideas on which abstruse problems of Probability are based admit of being so presented to any intelligent person as to be grasped by him, even though he be quite ignorant of mathematics. The conditions of doing so are that the lessons shall be as far as possible 'Object lessons', in which real objects shall be handled as in the Kindergarten system, and simple operations performed and not only talked about. I am anxious to make myself so far understood, that some teachers of science may be induced to elaborate the course that I present now

only in outline. It seems to me suitably divisible into a course of five lessons of one hour each, which would be sufficient to introduce the learner into a new world of ideas, extraordinarily wide in their application. A proper notion of what is meant by Correlation requires some knowledge of the principal features of Variation, and will be the goal towards which the lessons lead.

To most persons Variability implies something indefinite and capricious. They require to be taught that it, like Proteus in the old fable, can be seized, securely bound, and utilized; that it can be defined and measured. It was disregarded by the old methods of statistics, that concerned themselves solely with Averages. The average amount of various measurable faculties or events in a multitude of persons was determined by simple methods, the individual variations being left out of account as too difficult to deal with. A population was treated by the old methods as a structureless atom, but the newer methods treat it as a compound unit. It will be a considerable intellectual gain to an otherwise educated person, to fully understand the way in which this can be done, and this and such like matters the proposed course of lessons is intended to make clear. It cannot be expected that in the few available minutes more than an outline can be given here of what is intended to be conveyed in perhaps thirty-fold as much time with the aid of profuse illustrations by objects and diagrams. At the risk of being wearisome, it is, however, necessary to offer the following syllabus

of what is proposed, for an outline of what teachers might fill in.

The object of the first lesson would be to explain and illustrate Variability of Size, Weight, Number, &c., by exhibiting samples of specimens that had been marshalled at random (Fig. 1), or arrayed in order of their magnitude (Fig. 2). Thus when variations of length were considered, objects of suitable size, such as chestnuts, acorns, hazel-nuts, stones of wall fruit, might be arrayed as beads on a string. It will be shown that an 'Array' of Variates of any kind falls into a continuous series. That each variate differs little from its neighbours about the middles of the Arrays, but that such differences increase rapidly towards their extremities. Abundant illustration would be required, and much handling of specimens.

Arrays of Variates of the same class strung together, differing considerably in the number of the objects they each contain, would be laid side by side and their middlemost variates or 'Medians' (Fig. 3) would be compared. It would be shown that as a rule the Medians become very similar to one another when the numbers in the Arrays are large. It must then be dogmatically explained that double accuracy usually accompanies a four-fold number, a treble accuracy a nine-fold number, and so on.

(This concludes the first lesson, during which the words and significations of Variability, Variate, Array, and Median will have been learnt.)

The second lesson is intended to give more precision to the idea of an Array. The variates in any one of these strung loosely on a cord, should be disposed at equal distances apart in front of an equal number of compartments, like horses in the front of a row of stalls (Fig. 4), and their tops joined. There will always be one more side to the row of stalls than there are objects, otherwise a side of one of the extreme stalls would be wanting. Thus there are two ways of indicating the portion of a particular variate, either by its *serial number* as 'first', 'second', 'third', or so on, or by *degrees* like those of a thermometer. In the latter case the sides of the stalls serve as degrees, counting the first of them as 0°, making one more graduation than the number of objects, as should be. The difference between these two methods has to be made clear, and that while the serial position of the Median object is always the same in any two Arrays whatever be the number of variates, the serial positions of their subdivisions cannot be the same, the ignored half interval at either end varying in width according to the number of variates, and becoming considerable when that number is small.

Lines of proportionate length will then be used drawn on a black board, and the limits of the Array will be also drawn, at a half interval from either end. The base is then to be divided centesimally.

Next join the tops of the lines with a smooth curve, and wipe out everything except the curve, the Limit at either side, and the Centesimally divided Base (Fig. 5).

This figure forms a Scheme of Distribution of Variates. Explain clearly that its shape is independent of the number of Variates, so long as they are sufficiently numerous to secure statistical constancy.

Show numerous schemes of variates of different kinds, and remark on the prevalent family likeness between the bounding curves. (Words and meanings learnt—Schemes of Distribution, Centesimal graduation of base.)

The third lesson passes from Variates, measured upwards from the base, to Deviates measured upwards or downwards from the Median, and treated as positive or negative values accordingly (Fig. 6).

Draw a Scheme of Variates on the black board, and show that it consists of two parts; the median which represents a constant, and the curve which represents the variations from it. Draw a horizontal line from limit to limit, through the top of the Median, to serve as Axis to the Curve. Divide the Axis centesimally, and wipe out everything except Curve, Axis, and Limits. This forms a Scheme of Distribution of Deviates. Draw ordinates from the axis to the curve at the 25th and 75th divisions. These are the 'Quartile' deviates.

At this stage the Genesis of the theoretical Normal curve might be briefly explained and the generality of its application; also some of its beautiful properties of reproduction. Many of the diagrams already shown would be again employed to show the prevalence of approximately normal distributions. Exceptions of

strongly marked Skew curves would be exhibited and their genesis briefly explained.

It will then be explained that while the ordinate at *any* specified centesimal division in two normal curves measures their relative variability, the Quartile is commonly employed as the unit of variability under the almost grotesque name of 'Probable Error', which is intended to signify that the length of any Deviate in the system is as likely as not to exceed or to fall short of it. This, by construction, is the case of either Quartile.

(New words and meanings—Scheme of Distribution of Deviates, Axis, Normal, Skew, Quartile, and Probable Error.)

In the fourth lesson it has to be explained that the Curve of Normal Distribution is not the direct result of calculation, neither does the formula that expresses it lend itself so freely to further calculation, as that of Frequency. Their shapes differ; the first is an Ogive, the second (Fig. 7) is Bell-shaped. In the curve of Frequency the Deviations are reckoned from the Mean of all the Variates, and not from the Median. Mean and Median are the same in Normal Curves, but may differ much in others. Either curve can be transformed into the other, as is best exemplified by using a Polygon (Fig. 8) instead of the Curve, consisting of a series of rectangles differing in height by the same amounts, but having widths respectively representative of the frequencies of 1, 3, 3, 1. (This is one of those known as a binomial series, whose

genesis might be briefly explained.) If these rectangles are arrayed in order of their widths, side by side, they become the equivalents of the ogival curve of Distribution. Now if each of these latter rectangles be slid parallel to itself up to either limit, their bases will overlap and they become equivalent to the bell-shaped curve of Frequency with its base vertical.

The curve of Frequency contains no easily perceived unit of variability like the Quartile of the Curve of Distribution. It is therefore not suited for and was not used as a first illustration, but the formula that expresses it is by far the more suitable of the two for calculation. Its unit of variability is what is called the 'Standard Deviation,' whose genesis will admit of illustration. How the calculations are made for finding its value is beyond the reach of the present lessons. The calculated ordinates of the normal curve must be accepted by the learner much as the time of day by his watch, though he be ignorant of the principles of its construction. Much more beyond his reach are the formulae used to express quasi-normal and skew curves. They require a previous knowledge of rather advanced mathematics.

(New words and ideas—Curve of Frequency, Standard Deviation, Mean, Binomial Series.)

The fifth and last lesson deals with the measurement of Correlation, that is, with the closeness of the relation between any two systems whose variations are due partly to causes common to both, and partly to causes

special to each. It applies to nearly every social relation, as to environment and health, social position and fertility, the kinship of parent to child, of uncle to nephew, &c. It may be mechanically illustrated by the movements of two pulleys with weights attached, suspended from a cord held by one of the hands of three different persons, 1, 2, and 3. No. 2 holds the middle of the cord, one half of which then passes round one of the pulleys up to the hand of No. 1; the other half similarly round the other pulley up to the hand of No. 3. The hands of Nos. 1, 2 and 3 move up and down quite independently, but as the movements of both weights are simultaneously controlled in part by No. 2, they become 'correlated'.

The formation of a table of correlations on paper ruled in squares, is easily explained on the blackboard (Fig. 9). The pairs of correlated values A and B have to be expressed in units of their respective variabilities. They are then sorted into the squares of the paper,—vertically according to the magnitudes of A, horizontally according to those of B—, and the Mean of each partial array of B values, corresponding to each grade of A, has to be determined. It is found theoretically that where variability is normal, the Means of B lie practically in a straight line on the face of the Table, and observation shows they do so in most other cases. It follows that the average deviation of a B value bears a constant ratio to the deviation of the corresponding A value. This ratio is called the 'Index of Correlation',

and is expressed by a single figure. For example: if the thigh-bone of many persons deviate 'very much' from the usual length of the thigh-bones of their race, the average of the lengths of the corresponding arm-bones will differ 'much', but not 'very much', from the usual length of arm-bones, and the ratio between this 'very much' and 'much' is constant and in the same direction, whatever be the numerical value attached to the word 'very much'. Lastly, the trustworthiness of the Index of Correlation, when applied to individual cases, is readily calculable. When the closeness of correlation is absolute, it is expressed by the number 1·0, and by 0·0, when the correlation is nil.

(New words and ideas—Correlation and Index of Correlation.)

This concludes what I have to say on these suggested Object lessons. It will have been tedious to follow in its necessarily much compressed form but will serve, I trust, to convey its main purpose of showing that a very brief course of lessons, copiously illustrated by diagrams and objects to handle, would give an acceptable introduction to the newer methods employed in Biometry and in Eugenics. Further, that when read leisurely by experts in its printed form, it would give quite sufficient guidance for elaborating details.

Influence of Collective Truths upon Individual Conduct.

We have thus far been concerned with Probability, determined by methods that take cognizance of Variations, and yield exact results, thereby affording a solid foundation for action. But the stage on which human action takes place is a superstructure into which emotion enters, we are guided on it less by Certainty and by Probability than by Assurance to a greater or lesser degree. The word Assurance is derived from *sure*, which itself is an abbreviation of *secure*, that is of *se- cura*, or without misgiving. It is a contented attitude of mind largely dependent on custom, prejudice, or other unreasonable influences which reformers have to overcome, and some of which they are apt to utilize on their own behalf. Human nature is such that we rarely find our way by the pure light of reason, but while peering through spectacles furnished with coloured and distorting glasses.

Locke seems to confound certainty with assurance in his forcible description of the way in which men are guided in their daily affairs (*Human Understanding*, iv, 14, par. 1):

Man would be at a great loss if he had nothing to direct him but what has the certainty of true knowledge. For that being very short and scanty, he would be often utterly in the dark, and in most of the actions of his life, perfectly at a stand, had he nothing to guide

him in the absence of clear and certain knowledge. He that will not eat till he has demonstration that it will nourish him, he that will not stir till he infallibly knows the business he goes about will succeed, will have little else to do but to sit still and perish.

A society may be considered as a highly complex organism, with a consciousness of its own, caring only for itself, establishing regulations and customs for its collective advantage, and creating a code of opinions to subserve that end. It is hard to over-rate its power over the individual in regard to any obvious particular on which it emphatically insists. I trust in some future time that one of those particulars will be the practice of Eugenics. Otherwise the influence of collective truths on individual conduct is deplorably weak, as expressed by the lines:—

> For others' follies teach us not,
> Nor much their wisdom teaches,
> But chief of solid worth is what
> Our own experience preaches.

Professor Westermark, among many other remarks in which I fully concur, has aptly stated (*Sociological Papers*, published for the Sociological Society. Macmillan, 1906, vol. ii, p. 24), with reference to one obstacle which prevents individuals from perceiving the importance of Eugenics, 'the prevalent opinion that almost anybody is good enough to marry is chiefly due to the fact that in this case, cause and effect, marriage and the feebleness of the offspring, are so distant from each other that the *near-sighted eye* does

not distinctly perceive the connexion between them.' (The Italics are mine.)

The enlightenment of individuals is a necessary preamble to practical Eugenics, but social opinion is the tyrant by whose praise or blame the principles of Eugenics may be expected hereafter to influence individual conduct. Public opinion may, however, be easily directed into different channels by opportune pressure. A common conviction that change in the established order of some particular codes of conduct would be impossible, because of the shock that the idea of doing so gives to our present ideas, bears some resemblance to the conviction of lovers that their present sentiments will endure for ever. Conviction, which is that very Assurance of which mention has just been made, is proved by reiterated experience to be a highly fallacious guide. Love is notoriously fickle in despite of the fervent and genuine protestations of lovers, and so is public opinion. I gave a list of extraordinary variations of the latter in respect to restrictions it enforced on the freedom of marriage, at various times and places (*Sociological Papers*, quoted above). Much could be added to that list, but I will not now discuss the effects of public opinion on such a serious question. I will take a much smaller instance which occurred before the time to which the recollections of most persons can now reach, but which I myself recall vividly. It is the simple matter of hair on the face of male adults. When I was young, it was an unpardonable offence for any English person other than

a cavalry officer, or perhaps some one of high social rank, to wear a moustache. Foreigners did so and were tolerated, otherwise the assumption of a moustache was in popular opinion worse than wicked, for it was atrociously bad style. Then came the Crimean War and the winter of Balaclava, during which it was cruel to compel the infantry to shave themselves every morning. So their beards began to grow, and this broke a long established custom. On the return of the army to England the fashion of beards spread among the laity, but stopped short of the clergy. These, however, soon began to show dissatisfaction, they said the beard was a sign of manliness that ought not to be suppressed and so forth; and at length the moment arrived. A distinguished clergyman, happily still living, 'bearded' his Bishop on a critical occasion. The Bishop yielded without protest, and forthwith hair began to sprout in a thousand pulpits where it had never appeared before within the memory of man.

It would be no small shock to public sentiment if our athletes in running public races were to strip themselves stark naked, yet that custom was rather suddenly introduced into Greece. Plato says (Republic V, par. 452, Jowett's translation):

Not long ago the Greeks were of the opinion, which is still generally received among the barbarians, that the sight of a naked man was ridiculous and improper, and when first the Cretans and the Lacedaemonians introduced naked exercises, the wits of that day might have ridiculed them. . . .

Thucydides (I. 6) also refers to the same change as occurring 'quite lately'.

Public opinion is commonly far in advance of private morality, because society as a whole keenly appreciates acts that tend to its advantage, and condemns those that do not. It applauds acts of heroism that perhaps not one of the applauders would be disposed to emulate. It is instructive to observe cases in which the benevolence of public opinion has outstripped that of the Law —which, for example, takes no notice of such acts as are enshrined in the parable of the good Samaritan. A man on his journey was robbed, wounded, and left by the wayside. A priest and a Levite successively pass by and take no heed of him. A Samaritan follows, takes pity, binds his wounds, and bears him to a place of safety. Public opinion keenly condemns the priest and the Levite, and praises the Samaritan, but our criminal law is indifferent to such acts. It is most severe on misadventure due to the neglect of a definite duty, but careless about those due to absence of common philanthropy. Its callousness in this respect is painfully shown in the following quotations (Kenny, *Outlines of Criminal Law*, 1902, p. 121, per Hawkins in Reg. v. Paine, *Times*, February 25, 1880):

> If I saw a man who was not under my charge, taking up a tumbler of poison, I should not be guilty of any crime by not stopping him. I am under no legal obligation to protect a stranger.

That is probably what the priest and the Levite of the parable said to themselves.

A still more emphatic example is in the *Digest of Criminal Law*, by Justice Sir James Stephen, 1887, p. 154. Reg. v. Smith, 2 C. and P., 449:

> *A* sees *B* drowning and is able to help him by holding out his hand. *A* abstains from doing so in order that *B* may be drowned, and *B* is drowned. *A* has committed no offence.

It appears, from a footnote, that this case has been discussed in a striking manner by Lord Macaulay in his notes on the Indian Penal Code, which I have not yet been able to consult.

Enough has been written elsewhere by myself and others to show that whenever public opinion is strongly roused it will lead to action, however contradictory it may be to previous custom and sentiment. Considering that public opinion is guided by the sense of what best serves the interests of society as a whole, it is reasonable to expect that it will be strongly exerted in favour of Eugenics when a sufficiency of evidence shall have been collected to make the truths on which it rests plain to all. That moment has not yet arrived. Enough is already known to those who have studied the question to leave no doubt in their minds about the general results, but not enough is quantitatively known to justify legislation or other action except in extreme cases. Continued studies will be required for some

time to come, and the pace must not be hurried. When the desired fullness of information shall have been acquired, then, and not till then, will be the fit moment to proclaim a 'Jehad,' or Holy War against customs and prejudices that impair the physical and moral qualities of our race.

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INDIVIDUALISM AND AFTER

It is a matter of peculiar satisfaction to me that the honour which has come to me of being asked to deliver the Herbert Spencer lecture before the University of Oxford should afford me the opportunity of speaking to you upon the subject which I have chosen for this address. It is not simply that it is a subject which lies very close to my mind and to my own work. One of the principal objects aimed at in this lecture will be to set out, within the brief limits allowed, reasons for conceiving the time in which we are living as the beginning of a period of development and reconstruction which must have unusual results in the future. To do this it is necessary to discuss the meaning of that profoundly influential tendency which has its roots deep in our history, and which is known, particularly in this country and in the United States, as Individualism. There has been no more characteristic, consistent, and devoted exponent of individualism in its theoretical and scientific aspects than Herbert Spencer. It is with this tendency, and with its relations to the principles of evolution, that his name is most closely associated. If it is necessary for the purpose I have in view to exhibit individualism not as an end in itself, but as a preparation for what is to come after, it will be, I trust, in the true spirit of evolutionary knowledge, and with an ever-present sense of the essential greatness of the work which Spencer has accomplished.

It may be recalled that it is now some three-quarters

of a century since John Henry Newman set out on a memorable journey for rest and contemplation in the south of Europe. He was at the time full of the spirit of unrest which was then striving in this University; and he was to return later confirmed in the conviction which had been growing in his mind that there was something wrong in the conclusions which men were drawing from the prevalent tendencies of the time. This conviction, shared in by others and carrying different minds in different directions, was destined later to lead Newman, to the surprise of his generation, to turn his back finally on the principles of what up to that time had been one of the most successful developments in Western history. I refer to this period not because I wish to discuss in detail any of the controversies to which it gave rise, but because I desire to take it as a point of departure.

The time which intervenes between that period and our own has been filled with a series of movements which have extended outwards, apparently from many independent centres. They have come, indeed, to embrace in their influence not only much of the purely intellectual life of our time, but many of its deeper practical activities. In literature, in politics, in art, in legislation, in our conception of the national life, in our theories of society, and even in the fundamental conceptions of philosophy, the more vital controversies of the time all appear to centre round movements which have a certain feature in common. They are all movements the leaders of which emphasize a direction of progress which seems to be away from the principles of what we have known in the past as individualism. It is of these movements,

seen not in isolation, but as the details of a single development related to organic causes, that I wish to speak. Some of the phases of it are described as Reaction, others are spoken of with no less certainty as Revolution. But it is of this development, seen neither as reaction nor as revolution, but as a movement of Reconstruction, quite unusual as it appears to me in history, a movement carrying within itself not only the life of the future, but with equal certainty the meaning of the past, that I desire to discuss here.

Those who come after us will in all probability make allowance for the fact that it must be a very rare occurrence for any one of us to imagine this particular time in which we are now living as it will appear in the future. Any of us, for instance, may still to-day talk to men whose early years take them back to the days before the period of railways, telegraphs, and ocean steamships—to the days, that is to say, when all the activities of the world were still as distant from each other in time and space as they were in the days of Augustus Caesar. Those who are still our contemporaries have known the time when the white races of the world were scarcely more than a third of their present number, and when applied science had not yet begun those surprising transformations through which the face of this planet would appear changed, if it were possible for us to see it from the depths of space. Even those who are middle-aged can go back to the days before the doctrine of organic evolution, as we now know it, had yet been propounded, and to the time when, in all the sciences, the processes of thought were still striving to orient themselves to the

conception that the history of the world, and indeed of the whole material universe, was comprised within the brief space of 6,000 years.

The political changes are no less remarkable. They constituted, indeed, the principal and dominant preoccupation of men's minds throughout the whole of the period while this transition was in progress. Looking back over the nineteenth century, we see it now as emphatically the century of political democracy, the period of the incoming of the masses of the people to power. The century witnessed the final stages of that struggle, lasting from the Renaissance onward, in which the doctrines of individualism had gradually broken down in Western countries the religious and civil structure of society inherited from former generations. It was in these final stages, moreover, that effect was given to all the events which had preceded them. This was effected by the admission of the people to voting power in most of the leading nations of the West. What France attempted in the way of a universal franchise in its great revolution, and what the United States began in 1783, England completed by stages only in 1832, 1867, and 1885. Germany made advances towards the same goal in 1867 and 1871; and Italy, Holland, Spain, Belgium, and other countries have each in turn in recent days adopted a wide popular franchise. Scarcely more than a period of a hundred years, that is to say, has witnessed the steps which have effected silently what is probably the most pregnant political change that has ever taken place in the world, namely, the admission of the people to power among the leading nations of the

West by forms of electoral franchise which in most cases fall little short of universal suffrage.

It was in the conditions of Western thought in which this revolution was in progress that the doctrine of organic evolution through natural selection was launched in England by Darwin in the second half of the nineteenth century. It will be a fact familiar to most of us who have endeavoured to keep touch with the science and thought of other countries that the effects produced in England by this theory of organic evolution have been from the beginning deeper, more widespread, and more potent than in any other country. This is a result due to causes which are rarely referred to in our literature. I will endeavour here to touch briefly on one of the chief of those causes. It will bring me to the question to which it is one of the principal objects of this lecture to attempt an answer, namely, whether the altogether exceptional conditions of thought in which the doctrine of evolution was launched in Western history have not hitherto operated in preventing us from perceiving in some measure the real application to society of the larger meaning which is inherent in it.

In Great Britain the conflict in which the liberty of the individual had been attained had been exceptionally severe and prolonged. The prestige of the results obtained was so great that, as Maine points out, it has profoundly influenced the tendencies of development throughout the modern world.[1] This is, indeed, the ultimate fact of history, often hidden from sight when in the phrase of the day it is sometimes said that we are

[1] *Popular Government*, by H. S. Maine.

living in the age of the Americanization of the world. We have, therefore, to recognize the importance of the fact that the tendencies of thought which had produced individualism in Great Britain and the United States were, in the nature of things, exceptionally developed in both countries. These tendencies may be said to have culminated in England between 1850 and 1860.

One can hardly open any serious political or philosophical book of this period without being impressed with the peculiar intellectual atmosphere of the time. If we take a sober treatise like John Stuart Mill's *Logic*, or better still the same author's *Essay on Liberty*, it may be observed how throughout the argument history is made to furnish a kind of lurid background for the great theme which is in the author's mind, namely, the emancipation of the individual from government. We see government in all its forms presented by Mill essentially as a thing of evil. In the opening pages of the *Essay on Liberty*, the past is discussed as a time when government might indeed have been necessary to keep other tyrants in check, but in which it always tended to become, as Mill expressed it, 'the king of the vultures no less bent upon preying on the flock than any of the minor harpies.'[1] It is essential to remember that this view was not an exceptional one. It expressed the spirit of the dominant political and social philosophy of the period. Henry Sidgwick,[2] Leslie Stephen,[3] and many others[4]

[1] *On Liberty*, by J. S. Mill, c. i.

[2] *Henry Sidgwick, A Memoir*, by A. S. and E. M. S., c. ii.

[3] *The English Utilitarians*, vol. iii.

[4] Cf. Professor Marshall's *Principles of Economics*, vol. i, B. I. first edition.

have described to us in detail the remarkable ascendency in English thought, and at the centres of learning, of the general views represented by Mill at this period. The accepted social and political theories had all the same mark on them. Every kind of government and organized institution in the State tended to be regarded with suspicion by the leaders of the ruling school of opinion. In Herbert Spencer's Autobiography the reader realizes the kind of passionate hostility to all the activities of the State which Spencer inherited from his intellectual ancestry and obtained in particular from the environment of his time. The Synthetic Philosophy in its relation to society is much more than a system of philosophy. It is one of the greatest dramas ever produced by the human mind, a drama, unfolded in many volumes, of the emancipation of the activities of the individual from the rule of all governments and institutions—military, political, social, ecclesiastical, and economic—organized in the State. We have come to talk in these days of attracting the best ability to the service of the State. In the middle of the nineteenth century Mill would have none of it. It might, he said, place a most dangerous kind of premium on bureaucracy. For the more qualified the heads of officialism the greater, he said, would be the hold of the evil upon us.[1] All-embracing State functions, said Spencer, towards the end of his life-work, are characteristic of a low social type. Progress to a higher social type is marked by a gradual relinquishment by the State of its compulsory functions.[2]

[1] *On Liberty*, by J. S. Mill, c. v.
[2] *Principles of Ethics*, 369, see also 365–82.

The spirit of these opinions has pervaded the whole political and economic life of Great Britain in a period through which most of us have lived, at least in part. The emphasis was laid to an extraordinary degree not only on the unrestricted freedom, but on the self-sufficiency of the individual. Emancipated from government, the individual was capable, it was held, of reaching, through unrestricted competition with other individuals equally untrammelled, the very highest possible results in every sphere of human activity. And he was capable, it was said, of thus reaching them not only with the greatest profit to himself, but with the highest good to the greatest number of his fellows. The spirit of unlimited competition, of the most intense individualism, and at the same time of the widest cosmopolitanism, breathed through it all. Mill's principles sanctioned not only the freest exchanges of economic products, but also the freest exchanges of human labour between nations,[1] even, it would appear by implication, to the extent of working the mills of Lancashire with labour from Central Asia. The merchant, said Adam Smith, is the citizen of no country. It is not the advantage of society, but his own advantage, which the merchant has in view. But the merchant, by following his own advantage, is necessarily led at the same time to serve the best interest of society.[2] We speak nowadays of a possible divergence between the interests of the individual under conditions of unrestricted competition and the interests of society, and of the subordination of the individual to society.

[1] *Principles of Political Economy*, B. III. xvii.
[2] *Wealth of Nations*, iv.

The principles of the time were incompatible with the meaning which is usually attached to such a saying. 'If,' said Mill, 'all mankind minus one were of one opinion, and only one person were of the contrary opinion, mankind would be no more justified in silencing that one person, than he, if he had the power, would be justified in silencing mankind.'[1]

When Darwin published the *Origin of Species*, the firm hold which the doctrine of natural selection almost immediately obtained on men's minds in England was, I think, undoubtedly due in the first place to the resemblance which was discovered in it to the views which had thus come to prevail throughout the whole fabric of the social, political, and economic life of the time. Spencer, who had to some extent anticipated Darwin, and whose fundamental conceptions had been already developed in his early writings, immediately became the principal interpreter of the doctrine of evolution in its applications to society. The *Origin of Species* dealt principally with the individual struggle for existence in forms of life below human society. It appeared therefore to emphasize the universal self-sufficiency of the individual and the effectiveness of individual competition. Darwin seemed to lift the veil from life, and to present to the gaze of his time, as prevailing throughout nature, a picture of the self-centred struggle of the individual ruthlessly pursuing his own interests and yet unconsciously pursuing them, as it was the teaching of the economic science of the day that he pursued them in human society—to his own perfection and at the same time to the highest possible good of his kind.

[1] *On Liberty*, c. ii.

The doctrine of evolution, in short, appeared to give the last sanction to individualism and to all the tendencies which from the period of the Renaissance onwards had been making for emancipation. It was taken by many to be a doctrine which justified from the fundamental order of nature the claim of the individual to stand forth—as the extreme advocates of individualism had always insisted—independent of all social powers, organizations, institutions, and creeds, as being himself the end of evolution, the Atlas who carried forward on his shoulders, in the struggle which he waged with his fellows for his own visible interests in his own lifetime, the end and welfare of the whole order of the world which surrounded him.

The position which I have now to put before you may be described somewhat in this way. I need not here emphasize the importance of the work accomplished in our civilization by the theories of individualism. I have enlarged on that subject elsewhere. Only opinions held with similar strength and extremity of conviction could have achieved such results.[1] But the theory of organic evolution was launched in England, as I have here shown, when these theories of individualism had reached their extreme development. The phase of the evolution doctrine which Darwin presented at this psychological moment was a phase dealing almost exclusively with the struggle for existence as between individuals and among forms of life below human society. Darwin attempted no systematic study of society. A species is not in itself

[1] Cf. *Principles of Western Civilization*, New Edition, Introduction and cix–xi.

a social group, and there is little in any of his works to suggest to us the widely different principles, as I conceive them, which must regulate under the stress of natural selection the integration of social types and in particular of a social type resting ultimately on mind.[1]

I am therefore led to this question: Can it be that the meaning of our times, and even the real meaning of the doctrine of evolution in its applications to society, have been hitherto largely obscured from us through seeking to interpret both through the theories of individualism? Or I would put it in this way: Have we still to recognize the fact that the individualism I have been here describing has no final meaning in itself, and that its real significance lies in the fact that it is the doctrine of a transition period preliminary to and preparatory to a more important stage upon which we are already entering?

You will admit, perhaps, that these are important questions. If they have to be answered in any degree in the affirmative, those who are still young among us will probably live to see great developments. In attempting to find an answer to them, it is, perhaps, desirable to

[1] Thus in *The Descent of Man* Darwin appears to think that civilized nations, by their practice of caring for the sick and maimed, are tending to suspend the operation of the law of natural selection in society by preventing the elimination of the unfit. There is no discussion of the organic meaning in the integration of society of the growing sense of responsibility to life which is characteristic of the more civilized races, or of the significance in relation to the law of natural selection in social evolution, as distinct from individual evolution, of the deepening of the social consciousness of which this sense of responsibility to our fellow creatures is one of the outward marks.

turn now for a moment away from the conclusions of theoretical knowledge as they have hitherto prevailed amongst us, and to envisage the actual world of to-day as it exists in the making—the grim, stressful world of life, where movements in thought and action are emerging largely independent of past theories and in obedience only to the forces of growth which are producing them. Let us see how far the exponents of individualism are proving themselves to have been justified in their claim to have explained to us the direction and meaning of our times.

If we regard existing tendencies in the State, and in particular those movements of the time which most evidently have the life of the future in them, the facts are of a kind to cause reflection. For the past thirty or forty years in England development in the State has been decidedly in a particular direction. So far from witnessing any tendency to the progressive restriction of the functions of the State, which was anticipated in the dominant political theories of the recent past, we have to take note of the rapid and continuous extension in every direction of its power and responsibilities. This development has become one of the most marked features of our time. It extends to all the activities of government, from national and imperial interests to municipal affairs. The enormous extension of the functions of the State is indicated by the increase in expenditure. For two decades, almost though not quite coincident with the sixties and seventies—that is to say, after the doctrines of individualism had reached their highest influence in Great Britian—the public expenditure of the United King-

dom, we may observe, tended to remain almost stationary. But it has since almost doubled in amount. The rate of increase, also, is most rapid in recent years. This is not by any means occasioned simply by increased expenditure on the defensive services. The increase, for instance, in the large expenditure of the purely civil services of the State has been quite fifty per cent. in the ten years preceding this in which we are living.

The extension in the functions of government indicated by the growth of local and municipal taxation has been still greater. During the past fifteen years the amount raised as revenue by local authorities in the United Kingdom, from rates alone, excluding income from public undertakings, loans, and other sources, has more than doubled. It now reaches a sum equal to the total of the annual national expenditure a quarter of a century ago. I need not enlarge upon the history of the extension of the functions of the State which lies behind these facts. It forms indeed the principal part of the history of our times. One has but to reflect that almost every large contentious question of the day involves some proposal to extend the functions of the State, to realize how considerable the change has been. The development in question touches almost every sphere of the activities of our time. In commerce, industry, finance, public undertakings, education, law, agriculture, health, morals, in all the relations of labour to the State and to Capital, and in the relations of the national activities to those of other countries, we have to notice how the functions of the State are being extended on every hand. It must be confessed that there is no indication here of that

progressive relinquishment by the State of its functions which was anticipated by Spencer. The reasons also which J. S. Mill considered cogent and conclusive that there should be a restriction of government to the lowest possible minimum do not seem to have prevailed in practice.

The feeling which may be distinguished in the general mind as prompting these marked changes calls specially for remark. There are a great number of opinions about the extension of the functions of the State, and there is great diversity of view even amongst those who are most active in desiring it. There is, however, I think, a common denominator to which all the views may be reduced in so far as they are submitted in the public interest. They may all be distinguished as urging a more organic conception of society. It was the most fundamental principle of the individualism of the past that the interests of the individual in pursuit of his own ends in competition with his fellows was coincident with the highest good of society. *Laissez-faire* therefore became a first principle of government. What we are apparently now witnessing, with the extension of the functions of the State, is the growth of a conviction that the two things are not the same, and that the highest good of the community is not, and possibly cannot be, reached by unregulated competition between private interests. This is obviously the opinion which is common to all the theories of extension of the functions of government. But it will be observed how it strikes at the central principle of the dominant theories of the past.

The opinion of economists of the ruling English school

in the past has been most pronounced. The individual, according to Adam Smith, in following his own advantage, was necessarily best serving the interests of society. But for the past half-century, in the relations between capital and labour on the one hand, and between the State and labour on the other, the corporate consciousness appears to have been gradually withdrawing its assent to this opinion. We have accordingly had in England an increasing tendency towards the interference of the State in the struggle between individuals. Legislative Acts have been passed which have regulated employment in factories, which have forbidden child-labour, which have reduced the hours of labour, which have given the right of combination to workmen, and which have even given official recognition to the principle that in agreements between labour and public authorities there should be a fair wage as distinguished from a competitive wage. Here again it is the more organic view which seems to be prevailing, in that the fact is emphasized that the good of the competitors in a state of unrestricted competition between individuals is not the same thing as the good of society.

When we turn from the State in its relation to labour to the State in relation to capital the facts continue to suggest reflection. The old individualistic theory of the State contemplated, as has been said, the prevalence of practically unrestricted competition as the principle of life in all things. But the sponsors for this view do not seem to have anticipated to any extent the kind of problems arising out of the modern tendencies of the world under stress of competition. One of the most

noticeable facts of the time, resulting largely from that shrinkage of the world as regards time and distance already referred to, is the tendency of capital to aggregation and then to forms of oligarchy as an ultimate phase inherent in the conditions of competition.

Those who have anticipated the system of voluntary co-operation, which Spencer said was to take the place of the State in the future, have always given us the instance of joint-stock enterprise as one of the best examples of how the functions of the State were to be superseded by private enterprise. Here it was said we have a voluntary republic engaged in a business enterprise. Every shareholder has the right to vote; the shareholders elect and control the management, and all the benefits are equally divisible. Finally, ownership in modern joint-stock enterprise is becoming more and more widely distributed, and is tending to embrace all the activities of our time. We have thus in view, it was said, all the stages of the easy and successful accomplishment of what Spencer predicted.

But when we look at the real facts of the world the conditions present something quite different. Under the modern tendency of capital to aggregation, we seem to see nearly every one of the vital principles of co-operation, which it has taken the political State thousands of years of evolution to establish only partially, fundamentally violated, and this apparently by necessity inherent in the conditions. For instance, from long before the days so familiar to us in history, when we see the select body of Athenian citizens assembling in person in the Pnyx as the ultimate source of all law and authority, down

to the present day, the continuous struggle in the political State has been a vote for every man, and then for an equal vote not weighted by wealth or position. But the first principle of joint-stock enterprise is of necessity voting power according to the amount of holding. The tendency from the outset is therefore towards oligarchy, this becoming pronounced as aggregation continues.

Problems like representation, the necessity for publicity, the continuity of membership, the identification of the interests of the management with those of the members, and many others which it has cost the State such struggles to overcome, find no solution in joint-stock enterprise. Under the modern conditions of sale and purchase many of them have assumed new phases. It is inevitable, also, that it should be possible for the management to enrich themselves simply by foreseeing, as a matter of course, the rise and fall of the stock-exchange values of their securities.

Driven by the stress of competition, the tendency of capital to aggregation is producing other results that are remarkable. The United States Steel Corporation recently held its annual meeting in America. This corporation has control of revenues and finances which compare with those of a first-class State. It deals with one of the greatest industries in the world, and its shareholders are widely distributed in many countries. In a newspaper report of the meeting we read that the management voted proxies representing some 4,700,000 shares. The number of stock-holders who attended and voted personally was twenty. The report added laconically that all the acts of the management during the year were confirmed.

An example of this kind brings fairly home to the mind how the conditions of the world are moving beyond the older theories. Beneath all the extreme views of the time we may distinguish, I think, the growth of a general feeling that the interests of competitors following their own ends in a state of unregulated competition between capital, equally as in the case of unregulated competition between labour, may possibly not be as economists in the past imagined, the same thing as the interests of society. It is, in short, in this case also, towards some more organic conception of society than was contemplated in the individualistic theories of the past that the facts of the time seem to be carrying us.

If we extend our view into the relation of States to each other, and into the conceptions of the meaning of the State, an equally striking change seems to be taking place in our time. One of the most pronounced characteristics of Western thought towards the middle of the nineteenth century was its cosmopolitanism. That earlier political phase which had been represented in France by the literature of the Revolution, and that other culture phase which had been nurtured in Germany on the universalist conceptions of Kant, Lessing, Herder, Goethe, and other interpreters, had been provided in England with a practical basis. It was insisted that the ideal condition of the world for the maximum production of wealth, and therefore, it was said, for international peace and progress, was one in which the exchanges of both labour and capital would be so absolutely untrammelled by considerations of nationalism that they would move, for instance, between China and England, as Mill

said, with the same ease and freedom as between two English counties.

No change which has taken place in the world in our time is more striking than the assertion of what has been called the passion of nationalism against the cosmopolitan ideals of the Early Victorian period. This movement takes in our day innumerable forms.[1] It extends from the Celtic revival, through many recent expressions of nationalism in Great Britain, the United States, and other countries, up to what is called a policy of imperialism, the latter embracing among ourselves both political and economic proposals for the federation of the British Empire. In these movements the increasing emphasis that is laid on the life-principle of small nationalities is very often contrasted with imperialism, the two tendencies being regarded as antagonistic. I think this view is possibly not correct.

What we are witnessing here also is, I think, the same gradual and general movement of the social mind towards a more organic conception of society. The ideas of growth, development, and progress now coming to be scientifically applied to society are in their very nature inseparably connected with the future. In the case of the social organism, as in the case of the individual, the difference between the more evolved and the primitive mind consists largely in the power of subordinating the passing needs of the present to those more organic needs which include the welfare of the future. A most marked and universal feature of social progress at the present time

[1] Compare its expression, for instance, in Mr. G. K. Chesterton's *Napoleon of Notting Hill.*

is therefore the increasing perception of the importance in the evolution of the world of the ideas which render society more organic in this sense of subordinating the present to the future. They are the greatest, the most lasting, and the most potent asset that a people can possess. It is in the increasing perception of the relation of this fact to all the ideas included under the head of nationalism that we have, I think, the true explanation of the present tendency throughout the world to emphasize nationality as a factor in evolution. It is a tendency which exists side by side with the conception of civilization as a whole developing toward a higher unity. But it is a tendency which is exercising at present a profoundly disturbing influence on many conceptions of the past and in particular on economic theories.

I have endeavoured to represent so far the meaning of our times to consist in a general movement of the Western mind under a great variety of phases towards a more organic conception of society. If I am right in this attempt, it is at this point, perhaps, that I approach most nearly the heart of the subject. It was pointed out at the beginning that when the theory of evolution was launched in England the conditions of thought were peculiar. If I were asked to choose a passage from the literature of the nineteenth century best calculated to exhibit the nature of the change I am attempting to describe, I would select a passage from Herbert Spencer's writings. It represents Spencer's position between what I think will prove to be two eras of the world's thought. The passage in question appears in an article published

in 1860[1], the subject of which was afterwards embodied, although not in such extreme form, in his *Principles of Sociology*.[2]

In this article Spencer examined the conception of the social organism, comparing the principles of its life with those of the individual organism. He found the two in agreement in many conspicuous peculiarities. But there was, he said, one fundamental difference. While in the individual organism the welfare of all the parts is rightly subservient to the welfare of the whole, in society the living units, he said, could never merge their individual interests and consciousness in any corporate consciousness. 'And this,' continued Spencer, 'is an everlasting reason why the welfare of citizens cannot rightly be sacrificed to some supposed benefit of the State. . . . The corporate life here must be subservient to the lives of the parts, instead of the lives of the parts being subservient to the corporate life.'

If we scrutinize closely the terms of this statement we must, I think, recognize it as epitomizing, in a manner so complete as to be found nowhere else, the spirit and meaning of the phase of thought known as individualism. Spencer's saying that the corporate life must be subordinate to the lives of the units, and not the units to the corporate life, represents probably the highest point touched in Western history by the claims of individualism. It marks the distance which had been travelled from the Greek theory of society. But it marks also, I think, no less decidedly the position to which we will

[1] *Westminster Review*, January, 1860.

[2] *Principles of Sociology*, 212–71.

in future look back as the starting-point of a new development.

Now if with this passage from Spencer in mind we turn again to the history of our times, nothing can be more significant than the effect which the more organic conception of society may be seen to be producing on the doctrine of evolution itself in its applications to social theories. It will be apparent, on reflection, that Spencer's conception of a corporate life subordinate to the interests of the units comprising it, is in the nature of things invalid. It is the correlative of that conception of the individual struggle for existence which was first presented by Darwin. It is evident that it is impossible to conceive society in any scientific sense as a mere mob of units of this kind whose individual interests could be paramount over the corporate interests.

I have pointed out at some length elsewhere that the first meaning of an organism as such is that its efficiency is superior to the sum total of the efficiency of all its individual units acting as units.[1] The evolution of society under the stress of natural selection is along the lines of its greatest efficiency, and it follows that in all the struggles of human history what is gradually being evolved is the more efficient—that is to say, the more organic social type. Whether the individual be conscious of it or not, the tendency of the evolutionary process will therefore inevitably render the interests of the units subordinate to the interests of the corporate life.

As soon as we realize this it appears to me that we

[1] *The Significance of the Future in the Theory of Evolution*: Two lectures, Royal Institution, London, 1906.

come in sight of a new set of ideas. What we see is that in society the meaning of evolution can centre only in a secondary sense in the struggle for existence between individuals. As in the case of nationality, though in a deeper sense, the ruling meaning of the social process lies in the causes which are rendering society increasingly organic by subordinating the units to the meaning of the whole and the present to the meaning of the future. It is the ideas and the integrating conceptions of the human mind, hitherto mainly represented in the great systems of religion which are rendering society organic in this higher sense, that furnish the principles round which the process of social evolution centres and that constitute the greatest asset which a civilization can possess. It is here again with the social organism as with the individual organism. The struggle in the primitive stage is for the present life. But as integration continues, the difference between the primitive and the more evolved consists, as has been said before, largely in the power of subordinating the impulses of the present to the more organic needs in which the welfare of the future is included. The history of the world is not simply a history of the struggle for life. It is to an ever-increasing degree a history of the struggle for the life of the future.

If we look round the world we see most of the leading nations burthened with huge national debts, which often constitute a great encumbrance to their development. It is a matter of general knowledge that no civilized people has yet been able consistently to follow such a moderate policy of subordination of the present to the

future as would suffice to wipe out in the course of a generation these heavy mortgages on the future. So little is the social consciousness organic under the influence of motives of this kind. Whether we regard man as a political animal or as an economic animal, we see him in history as Dryden described him,

> Unconstant still, and various;
> There's no to-morrow in him like to-day.

But there is a point of view from which we get a different spectacle. We see the Western peoples as a whole held in a system of ideas which dates back to the Christian era. The conceptions arising out of these ideas have influenced at every point the development of our political and social institutions, our standards of conduct and our laws. Under their influence generations of men have made the greatest sacrifices of which human nature is capable in order to subserve the ideals, personal, political, and social, which they have set before themselves under this influence. The conceptions in question have so profoundly deepened the social consciousness that for centuries we have been living in a development in which we see the occupying classes unable to offer any serious resistance in yielding their places before the incoming people, first of all in the demand for equal political rights, and now in the demand for the equality of opportunity. Although it is a commonplace of thought, it represents one of the profoundest of sociological truths when we say that these ideas have created the distinctive ethos of Western civilization; for they thereby continue to give direction, even though leaders of movements may often be entirely unconscious of it, to most of the ten-

dencies which are recognized as characteristic of our times.

It would be impossible to conceive any economic or political motive influencing the human mind so consistently and so continuously, and on so large a scale, and producing over so prolonged a period results of such character and magnitude. It has been said of the Synthetic Philosophy that Spencer found little place in it for systems of religion except in relation to our emancipation from the past. But no change which is in progress in our time as the result of the extending conception of society is more striking than that which is taking place in our estimate of the influence in the evolution of society of the integrating conceptions of the human mind hitherto represented mainly in the great systems of religion, which are thus in the deepest sense of all rendering society organic. It would seem as if it is these stones which the builders of social science in the past have rejected that we must place now as the head-stones of the corners.

I must not stay to follow this movement of change into its effects on the current developments in philosophy, and even on our current theories of art. Nor can I wait to discuss the influence on many systems of thought, of the conception that the full meaning of the individual is in the social process, and that it cannot therefore be reached through an introspective study alone of the individual's mind. For it is not so much the human mind which is constructing the social process. It is the social process which is constructing the human mind. I must make allowance for the possibility that I may be speaking ignorantly, and therefore altogether

overrating the importance of the change as it appears to me. But these conceptions, as I see them, in their wider applications, seem to imply that we are reaching thereby one of the most pregnant positions in the development of Western thought since the days of Plato.

If I pursue to the end the more direct issues suggested by the line of thought I have here opened, I cannot, perhaps, avoid considering the more immediate practical applications. No one can follow in their relation to the modern socialist movement any of the larger questions of the day without perceiving how serious and far-reaching are the problems which are tending to be associated with this universal deepening of the social consciousness. There are, however, certain facts of the time which add greatly to the difficulties of many in seeking for guidance as to the direction in which new developments may be carrying us. The great authority justly acquired among us of the views hitherto held by exponents of individualism, and the fact that the movement itself has been closely associated with one of the greatest developments in Western history, namely, that which has emancipated the activities of the individual, suggest a great weight of responsibility in giving countenance to any proposal for departure from principles so closely identified with a long era of successful development in the past. These reasons receive additional force and cogency for many persons when they observe the proposals which are often made by leaders on the other side in various contemporary movements.

It is possible that we are yet far from fully anticipating how the principles of the past may in their deeper meaning,

though not in their old form, be applicable to the future. It is not improbable that the gains of the past will be seen to be all necessary and preliminary to the next stage, and that continuity with the past will be clearly visible as that transition stage upon which we appear to be entering develops. Let me try to explain briefly what may possibly be before us.

Beneath all the extreme views of the time in many countries, there is a fact which must always be kept in mind. It is not the opinions of men, however earnest, which can give any type of society a permanent place in the world. We may hold any convictions about our Utopias, and we may even convince others as to the expediency of our views; but there is one condition alone upon which any institutions can ultimately prevail. They will have to win out in the stern stress of the world solely in respect of one quality—their efficiency. They must have the compelling merit of being efficient when compared with others.

Now regarding the current world as far as possible detached from prepossessions, we cannot mistake the fact that it is the organic principles and the organic views of society which are thus making headway. Although the prestige of the individualistic view of the world has been great in the past; although governments in many civilized countries seem to be continually protesting they will never consent to any radical interference with its principles; yet in the process of parliaments we seem to see most of them steadily consenting.

We are living, it must be remembered, in the days of organization. The nations who understand the meaning

of what Spencer called the long sequences in the social process have the power of producing results never before possible. The instinct which has recently possessed the world of the value of nationality in this new light has been referred to. But it suggests a wider meaning than I have touched on. In the rivalry of nations and peoples it is often as in the rivalry between individual forms of life. When a new environment arises, natural selection often finds the most suitable basis for adaptation in forms which were peculiar to earlier types. It is often overlooked, for instance, in the case of the great success of modern Germany, how much she owes to the fact that, in the current age of organization and long sequences, the institutions of an earlier order of society, largely directed through the State, have survived more completely than in England, where our long era of successful individualism has weakened the ideas on which they rested. Her State railways, for instance, primarily intended for military organization, have lent themselves with extraordinary success to the requirements of modern industry. And so in a hundred other instances in that country.

The case of Japan is a still more striking example. A generation or two ago the peculiar methods of work in that country were counted as no more than an interesting survival from an early age of social institutions. Gangs of Japanese navvies, for instance, in working used their picks in unison and struck their blows to the sound of some rhythmic measure. But when in the present age organization in its deeper sense has become a ruling principle of the world; when we see Western arts, arma-

ments, science, and industry adopted by the Japanese people, and the results directed through the nation as a whole with similar organic unison of purpose to thought-out ends in which there is a clear conception of the subordination of the present to the future, we have the surprising spectacle of an Eastern people in a decade or two emerging from the condition of mediaeval Europe and almost suddenly taking its place among the nations as one of the first powers of the world.

The present age, it has been said, is often spoken of as the age of the Americanization of the world, a phrase which implies the importance of a particular phase of our own development. There is, however, a deep and true sense in which the next age will probably be also the age of the Germanization of the world. For it is those lessons of which the first stages have been displayed in the history of modern Prussia which are likely to be worked out in their fuller applications by successful States in the future.

It is in this connexion that the larger meaning of our own history, including the meaning of our individualism in the past, will probably be visible. On the one hand it seems clear that we are moving towards organization in its larger applications, and are therefore reaching the time when the meaning of the interests of society in long sequences will be consistently applied to conceptions of national policy abroad and of social policy at home as they have never been applied before. But on the other hand there is a lesson upon which our history has placed an emphasis no less arresting. We profoundly distrust not only all despotisms, however benevolent, but all

oligarchies and bureaucracies, however enlightened, if allowed to reach their ultimate tendencies. Nay, more, we know, perhaps more thoroughly than any other people, that it is the meaning of the world that we do well to distrust them. It has happened, therefore, that in our history we have displaced all systems of authority as working principles of the State.

Now it is one of the features of all healthy organisms that their vital processes are for the most part subconscious. It is perhaps for this reason that we do not always, even in our textbooks, rise to the level of consciousness of what it is that constitutes the most characteristic, as it certainly is the most vital, of the principles expressed in our own evolution as a people, namely, the principle by which we have replaced all systems of authority in the State. It consists in practice in this: We recognize instinctively that no institution can be trusted to develop its full meaning and to maintain its efficiency except in one condition—the condition of continuous stress represented by the permanent competitive opposition of another institution in which is embodied a counter-principle. The constitutional struggle between the people and the sovereign in England gave us the parliamentary system with all its counterpoises. The conflict between centralization and decentralization has produced the colonial system of Great Britain and the federal constitution of the United States. And the stress of affairs has developed in English and American law and opinion a theory of the supreme importance of maintaining in all circumstances a free conflict of forces.

But over and above all other results this is the solution which, under the institution of party government, we have found for the problem of political democracy. Probably under no other condition could that problem —the supreme problem of the last two centuries—have been solved after we had displaced the theory of Divine right in the State. By the system of party government we have compelled each of the two permanent parties in the State—which have been in effect the occupying classes and the incoming classes—to organize its case to its fullest value on each side of a line of cleavage in a normal attitude of unchanging opposition. Although we are not yet in the position to fully appreciate the results, for we are still in the thick of the fight, they certainly mark one of the greatest achievements in history. For generations the case of the incoming party amongst us has been separated from its extravagances and absurdities: institutions have been modified gradually, and only as full proof has been shown; each party has retained the respect of the other without bitterness; and the occupying classes have come to accept the modifications which are taking place as part of the progressive order of the world.

It seems to me likely that it is this principle of efficiency which has enabled us thus to solve the transition of the modern world to political democracy—and modern popular government, as Maine said, is of purely English origin—that we are about to carry into the next and greater era of transition in which our problems will be economic rather than political. On the one side we see now a conviction strongly entrenched in all the

institutions of our time of the superiority of private enterprise under voluntary co-operation as applied to all the affairs of the world. On the other side we see largely held an opposing conviction that the necessity is developing for greatly extended corporate action on the part of the State, and that the corporate consciousness, acting through the State, can alone carry through those long sequences of the public weal in which the present must be subordinate to the future. We have here two counter-principles which the meaning of our history will, it seems to me, drive us to embody in two normally antagonized policies in the future. Probably in no other way can either policy be trusted to develop its full meaning and its full efficiency in the future.

If it be indeed that the State, under the direction of a more organic social consciousness, can carry forms of co-operative activity to results in the public interest which are beyond the powers of voluntary competitive enterprise, then of one thing we may be certain—there is no principle at present visible in the world which will ultimately prevent the State in successful societies from doing so.

I trust I have in some small measure succeeded in the object with which I set out in this lecture. I have endeavoured to exhibit the leading feature of our times as a movement of the world under many forms towards a more organic conception of society. It is a fact becoming visible that the social organism is tending to be regarded as something wider than the political State. It is a fact in evidence that the life of our civilization is more organic than the life of any of the States or

nations included in it. And it is a fact of the times also becoming clearer in social science that the fundamental principle of the life of that civilization is a common inheritance in the influence of those conceptions which have produced that progressive deepening of the social consciousness which I have described to you. But while all these things are so, it is probably equally true that never before did the organic principle of nationality count for more as one of the causes carrying us towards that higher stage when the social organism will be identical with civilization. Spencer contemplated voluntary co-operative enterprise as taking the place of the State. But he does not appear to have allowed for the fact that there is a sense in which the purified State may in future stand for the greatest of all voluntary co-operations. This ancient University has witnessed and taken large part in the events through which the main flood of the life of our civilization has come down in no small measure in the channels of our national history. It has seen a small nation expand into a world-wide empire whose constitution is so indefinite that it scarcely exists, but whose life is so incomprehensibly organic that it is able without any principle of compulsion, as we saw it able but yesterday, to summon its kin from the ends of the earth to fight in its cause. Nay, more, the history of this small nation has become the meaning of a larger system of life represented, as it will be within living experience, by two hundred millions, and within a century by four hundred millions, of people speaking one language and inheriting one law and one ethos. To understand these things is to feel the sense

of the organic upon us, and to realize deeply what that sense of the organic may accomplish in the future. We are probably entering on a new era of development, but we enter on it with an enormous impetus from history behind us.

I do not know, in conclusion, whether you will call me reactionary or revolutionary. If you would apply either adjective I would defend myself by quoting a conclusion reached by Spencer towards the end of one of his books.[1] The study of social science, he said, properly followed, had one marked result—it was likely to render the inquirer 'radical to a degree beyond anything which current radicalism conceives'; but at the same time 'conservative to a degree beyond anything conceived by present conservatism'.

[1] *The Study of Sociology*, xvi.

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HERBERT SPENCER
AND
ANIMAL EVOLUTION

THE HERBERT SPENCER LECTURE

DELIVERED AT THE MUSEUM ON
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BY

GILBERT CHARLES BOURNE

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HERBERT SPENCER AND ANIMAL EVOLUTION

THE subject I have chosen for the title of my lecture is a very large one, Herbert Spencer and Animal Evolution. It is impossible for me to attempt to deal with the whole or even with any considerable part of it in the course of a single lecture. But before I treat of that very limited aspect of it to which I propose to confine myself, I may, perhaps, indulge in a few generalities by way of an introduction.

During the last two years we have heard a great deal about Evolution, because of the various celebrations held in different places of the centenary of Darwin's birth, and because in July 1908 we arrived at the fiftieth anniversary of the famous meeting of the Linnean Society of London, at which the papers of Charles Darwin and Alfred Russell Wallace were read, suggesting Natural Selection as the efficient cause of the transformation of animal and vegetal species. And November 24 was the fiftieth anniversary of the publication of Darwin's *Origin of Species*. It is a popular error, but one which I need not be at the trouble to refute here, before an Oxford audience, that Darwin was the author of the theory of Evolution. We know that the idea of evolution dates back to the early Greek philosophers; that a scheme of organic evolution founded upon Greek philosophy was sketched by Lucretius; that evolutionary doctrines were freely promulgated in the eighteenth century by Leibnitz, Malebranche, Benoit de Maillet, and other philosophers, by Haller the physiologist, by Bonnet, Buffon, Wolff, and other zoologists; at the close of the century by Erasmus Darwin, and in the earliest years of the nineteenth century by Oken, Treviranus, Lamarck, only to mention a few names.

It is well known that the school of 'Natural Philosophers', of whom Oken and Treviranus were the leaders, were Platonists and disciples of Kant, and that their avowed aim was to explain natural phenomena on philosophic principles. Working with such biological evidence as the knowledge of their day afforded, they hazarded some wonderfully shrewd guesses, and exercised a considerable influence on the thought of their time, an influence not altogether baneful, as some writers would lead us to suppose. But they laboured under this great disadvantage, that the objective evidence at their disposal was altogether insufficient to sustain the bold and sweeping generalizations that they founded on it, and arguing deductively from these generalizations they were soon involved in absurdities and contradictions which were easily exposed and turned into ridicule by the more practical and sober-minded scientific workers of the day.

Cuvier, whose reputation as an exact and wide student of comparative anatomy and palaeontology has lost none of its lustre to this day, was a bitter opponent of the natural philosophers, and a strong advocate of the doctrine of the fixity of species, and he had the support of such eminent zoologists as Johannes Müller, von Baer, Milne Edwards, and others. It is curious to note how much evidence these noted investigators collected in favour of the doctrine of organic evolution, and yet how obstinately they set their faces against its acceptance.

But, although they appeared to have routed evolution and to have fairly driven it, as a guiding principle, from the scientific field; there remained a not inconsiderable body of scientific thinkers who could not rest content with the dogmatic assertions of the Cuvierian and Linnaean schools.

We have had evidence enough, during the present year, of the early period at which Charles Darwin's thoughts were turned towards an evolutionary interpretation of organic phenomena. We have not heard so much of the

part played by Herbert Spencer, who, as a public exponent of organic evolution, was in the field some years before Darwin wrote, and had anticipated some of his leading ideas. Spencer did not arrive at the idea of Natural Selection; that was first conceived by Darwin, jointly made public by Darwin and Wallace, and freely accepted by Spencer as conforming to and strengthening his scheme of organic evolution.

I have been speaking of Herbert Spencer as a biologist; to most persons he appears as a philosopher, who got his biological knowledge at second hand and wove the discoveries and opinions of other biologists into the fabric of his philosophical system. He has been accused of borrowing his zoology from Huxley, his botany from Hooker. It cannot be denied that there is a grain of truth in this accusation. The author of the *Synthetic Philosophy* could not have completed his task—he could scarcely have begun it—if he had attempted to undertake the laborious and time-consuming labours of an original investigator of natural phenomena, or even if he had attempted to verify by personal experience any considerable part of the evidence collected and handled in the two volumes of his *Principles of Biology*. But he spared no pains to make his knowledge exact. If he was not an original investigator, he was a conscientious student, and attended the lectures and the practical courses of the most eminent biological teachers of his time. His knowledge of biological literature was great—and it is a very abundant literature—his grasp of facts was unusual and his insight unequalled. His power of co-ordinating the evidence derived from the most different branches of biological studies was equal to that of Darwin himself, and his treatment of it led him to nearly identical conclusions. In some matters he anticipated Darwin's ideas. In particular, his theory of 'physiological units' was an anticipation of Darwin's theory of pangenesis, and the parent of all the various theories of vital units,

promulgated during the last fifty years, as explanations of vital phenomena; particularly of the phenomena of specific transformation, of inheritance and variation.

The theory of organic Evolution was of vital importance to Herbert Spencer's whole philosophical system. His interest in biology was at least equal to his interest in sociological questions. He contributed new and important ideas to biology, and to the end of his days was engaged in active controversy with Weismann, whose theory of the germ-plasm undermined some of his most important positions. It is assumed, perhaps a little too readily, that Weismann came off victorious in the contest, and I shall devote the rest of this lecture to a re-examination of the questions at issue between these two great antagonists, in the light of some recent zoological experiments.

I have not the time, and I do not think it is necessary, to give references and quotations; but it is, I think, a fair summary of Herbert Spencer's philosophical treatment of biological phenomena, to say that, for him, evolution is, in all its forms, a becoming of the heterogeneous and complex out of the homogeneous and simple. Thus, in his *First Principles*, he begins with a consideration of chemical and physical laws, and after treating of the interaction of these laws in the production of inorganic phenomena, he proceeds to apply the same principles to the solution of the problems offered by organic phenomena. I may give one quotation to illustrate his point of view.

'The formation of molecules more and more heterogeneous during terrestrial evolution has been accompanied by increasing heterogeneity in the aggregate of compounds of each kind, as well as an increasing number of kinds; and this increasing heterogeneity is exemplified in an extreme degree in the compounds, non-nitrogenous and nitrogenous, out of which organisms are built. So that classes, orders, genera, and species of chemical

substances, gradually increasing as the Earth has assumed its present form, increased in a transcendent degree during that stage which preceded the origin of life.'

Thus evolution was in progress long before life appeared on the globe, and the origin of life is due to the continuance of the process of the formation and recombination of more and more heterogeneous molecules. To explain the transition from non-living to living matter he assumed the coming into existence of 'physiological units'.

'There seems no alternative,' he wrote, 'but to suppose that the chemical units combine into units immensely more complex than themselves, complex as they are: and that in each organism the physiological units produced by this further compounding of highly compound molecules, have a more or less distinctive character. We must conclude that in each case some difference of composition in the units, or of arrangement in their components, leading to some difference in their mutual play of forces, produces a difference in the form which the aggregate of them assumes.'

We must take note of the fact that the physiological units are assumed to differ among themselves from the beginning, and that the interactions, resulting from these differences of chemical composition, induce further differences, which are expressed in the structure of the different parts of an organism formed by an aggregate of such units. Starting from this conception, it is a comparatively easy task to picture a gradual increase of complexity in the organic world, due on the one hand to the combinations of different kinds of units into aggregates, and the changes induced at once in the units and in their aggregates by the action and reaction of the units on one another. Due on the other hand to the action of incident forces, gravity, heat, light, electricity, chemical stimuli, mechanical stimuli, both on the units and on their aggregates, inducing change,

and these changes superinducing further changes, and so on in ever-increasing degrees of complexity.

Practically every author who has set out to explain biological evolution in terms of the ultimate constituents of organized matter, has found himself compelled to assume the existence of some such units as those postulated by Spencer, and there is a very general agreement as to the manner in which the evolution of the animal and vegetal world has proceeded from such a basis. The divergence of opinion begins when the attempt is made to interpret individual or, as we call it, ontogenetic evolution in terms of general or phyletic evolution, and when the units are used to explain the phenomena of inheritance and variation.

It is now a fact familiar to every educated person that every individual organism (exception being made, for the moment, of individuals propagated by buds or cuttings) has its origin in a germ-cell—a minute mass of the life-stuff we call protoplasm—which in its earliest phase shows no further visible structure than that it is composed of cytoplasm and nucleus.

It is further well known that, normally, the co-operation of two such cells, one called male, the other called female, is required to start those processes which lead to the building up of the adult organism. But, as we know of many cases in which a single germ-cell is capable of proceeding on its course of development without the co-operation of another, without being fertilized, as we express it; and as a consideration of the complication introduced by the act of fertilization is unnecessary for my argument, I will leave all question of male and female germ-cells out of consideration, and treat the subject as though only one cell were necessary, as is indeed often the case. The germ-cell divides into two, the nucleus heralding and sharing in the division. The two divide to form four, the four divide into eight, the eight into sixteen, and so on, until an aggregate is formed, often

of cells that are apparently alike, but it is obvious that they are really unlike, for when a certain number—a hundred and twelve it may be—are present, they form groups, and these groups undergo changes of position resulting in the formation of layers, the cells composing each layer being generally distinguishable by their form. In each layer fresh groups arise, their cells again exhibiting differences of form; and these groups undergo further re-arrangement, and so the process goes on until finally, as a result of the regrouping and differentiation of the cells, all derived from the original germ-cell, we get the specific organs arranged in the specific order characteristic of the adult organism.

Visibly, then, every individual animal and every plant goes through its own course of evolution. Its life-history is a becoming of the complex and heterogeneous out of the simple and homogeneous. Thus there is a parallelism between the evolution of any given individual organism, and the evolution of the whole assemblage of organisms that exist or ever have existed; more particularly a parallelism between the evolution of any given organism and the evolution of the race or kind to which it belongs.

But there is a great difference.

If, in imagination, we trace the genealogy of any animal back through the ages, we see that, in the beginning, it must have had its origin in *real* simplicity and homogeneity. All that is now complex and heterogeneous in any organism must have been added, bit by bit, part by part, as the result of countless interactions and reactions always in operation through the long course of time.

We cannot conceive, and we do not suppose, that the specific complexity of any given animal was present, in any sense, in the primordial ancestor from which it is descended. It is only a mystification to say, as some have said, that it was *potentially* present, since proto-

plasm, once it came into being, contained in itself all the properties necessary for the development of all the specific forms of life that now exist or have existed in the intervening ages. A statue is not contained potentially in a block of marble. It requires much play of incident forces before the statue is produced out of the block, and the most we can say is that the marble is, no doubt, a necessary condition of the statue. So primordial protoplasm was a necessary antecedent condition of the existing world of organization, but a vast play of incident forces has been required to develop that organization.

Phyletically, therefore, the heterogeneity that we see and recognize in animals in general has been acquired. There has been always, on the whole, an addition of something that was not there before. Sometimes, no doubt, a subtraction, sometimes neither addition nor subtraction, but a pause, for evolution has proceeded in many directions, and in some cases has stood still, but on the whole, a very great addition.

But in ontogeny—the evolution of the individual—the case is very different. Though the germ-cells of different animals appear to us very nearly or exactly alike, their behaviour shows us that they are not in the least degree alike. Their qualities are specific and tend to a specific result. That the hen's egg invariably gives rise to a fowl and a duck's egg to a duck, was a matter of wonder to the early philosophers, and it is a matter for wonder still, though the phenomenon is so familiar, that those who do not think about these things are apt to deride us for all the trouble we give ourselves about them. But it is the hall-mark of stupidity to take things for granted because they are familiar, and to fail to find matter for wonder and reflection in the common objects of life.

To Herbert Spencer the development of the heterogeneous adult out of the homogeneous germ-cell presented no great difficulty.

The germ-cell, thrown off by the parent form, is necessarily composed of the physiological units proper to that parent form, and consequently possessed of certain specific characters. These characters are nowhere clearly defined, but it is made clear that they are not to be considered as corresponding in any degree to the specific structural characters of the parent or of the adult form that is to be. The physiological units are conceived of as having a certain *polarity*, characteristic of the species to which they belong, and by reason of this polarity the units react in a certain way to the incidence of external forces, and in the course of cell-division and multiplication are redistributed in such a way as to cause them to react in a characteristic manner on one another, and thus to undergo modifications, determined in part by their own polarity, in part by the relations in which they stand to other units, and in part to the influence of external forces. These induced modifications in turn induce new modifications, both in the constituent physiological units and in the aggregate of which they form a part, and the result is an increasing complexity; but a complexity of a specific kind, partly because the reactions of the constituent physiological units are determined by their original polarity, partly because in the normal course of development of an individual animal, the environment, that is to say the incident forces, are the same or nearly the same, as in the development of other individuals of the same species.

On this supposition the evolution of the individual is as truly a progression from the homogeneous to the heterogeneous, as is the evolution of the race, and the parallelism between the two is nearly complete. Moreover, the phenomena of inheritance and variation are accounted for. For if the polarities of the units are alike, and the incident forces are alike, then the reactions will be alike, and the adult individual will be composed of the same kind of physiological units as were contained in

the germ-cell from which it was developed. This adult will in turn throw off germ-cells containing physiological units of its own kind, and the round will be completed in the same manner and result in the production of new individuals like to the first.

But, on the other hand, as the physiological units are not *exactly* alike among themselves, and as the incident forces to which the developing germ is subject cannot ever be *exactly* alike, the reactions between the two will always produce some differences in the adults, and these differences will be due to the changed composition of the physiological units composing them. Hence in every new generation the units will not only be slightly different from those of the parents, but will also be slightly different in the individuals composing the generation, and therefore in the germ-cells which they in their turn throw off. These germ-cells will therefore give rise once more to slightly different individuals, and so forth.

It is easy to see that the theory is still more useful in explaining the origin of variations when the mingling of slightly dissimilar physiological units in sexual reproduction is taken into account. But this need not distract our attention now.

The most important thing on which to fix our attention is that Spencer's theory states that acquired characters are transmitted by inheritance. By 'acquired characters', in this connexion, we mean the changes of constitution produced in the physiological units by their reaction to incident forces.

Darwin, who devoted many years to the study of Variation, agreed to a large extent with Herbert Spencer's view that variations are produced by the action of external forces.

'Changed conditions act in two ways, directly on the whole organization or on certain parts alone, and indirectly through the reproductive system. In all cases there are two factors, the nature of the organism, which

is much the most important of the two, and the nature of the conditions. The direct action of changed conditions leads to definite or indefinite results. In the latter case the organization seems to become plastic and we have much fluctuating variability. In the former case the nature of the organism is such that it yields readily, when subjected to certain conditions, and all or nearly all the individuals become modified in the same way.' [1]

Darwin had no doubt that variations, produced in this way, are inheritable, but he did not attach great importance to the direct action of external conditions as a means of producing modifications of structure, except in so far as they cause variations to arise and thus afford the material for the action of Natural Selection. I have quoted this passage because it contains reference to the distinction between 'the nature of the organism, *which is much the most important of the two*, and the nature of the conditions'.

Darwin, in a word, attached much more importance to the character of the organism throughout its whole history from the germ to the adult condition: Spencer attached much more importance to the direct modifying action of external conditions. As Weismann has pointed out, while Spencer gave an *epigenetic*, Darwin gave an *evolutionary* account of development, and invented the theory of pangenesis to account for the great complication of germinal structure necessary for the explanation of an evolutionary process in ontogeny.

The term 'evolutionary' as applied to ontogeny bears almost exactly the opposite meaning to that which it bears when applied to phylogeny. In the latter case it means a progress from the simple and undifferentiated to the complex and differentiated: in the former case it means the gradual unfolding and manifestation of a pre-existing complexity.

Darwin saw clearly that such a complexity must exist

[1] *Origin of Species*, 6th ed., 1880, p. 106.

in the germ; for if it did not, the facts of heredity could not be accounted for, and in his theory of pangenesis supposed that every cell in the body gave off minute gemmules, which, passing into the circulation, were stored in the germ-cells.

Sir Francis Galton experimentally disproved the theory of gemmules, and propounded a theory of 'stirps' to account for the phenomena of heredity. Into the details of this theory it is not now necessary to enter. It attracted little attention in this country and passed unnoticed on the Continent and in America; but it was, in fact, an anticipation of the principles underlying Weismann's more celebrated theory of the germ-plasm.

It is not my intention to attempt to give you an account of Weismann's theory, and it would be impossible to do so in the time at my disposal. It was explained by its author in the Romanes Lecture in 1894, and has since undergone some alteration, to harmonize it with the rapidly accumulating evidence on the numerous aspects of development and heredity—this evidence being the result of researches largely stimulated by the theory itself. The main features, however, remain unaltered, and I need only mention such of them as are directly relevant to Herbert Spencer's arguments.

In the first place, Weismann, by a careful criticism of a large number of supposed cases, rejected one of the main supports of Spencer's system. He showed that not only is there no evidence that characters acquired during the lifetime of an organism are transmitted to its descendants, but the evidence points strongly to the fact that such acquired characters are not and cannot be transmitted by inheritance.

If this is accepted as an established fact (as it is by most naturalists in this country, but not in America) it follows that the secular increase of complexity of organization demanded by the theory of Evolution cannot have been produced directly by the action of incident forces as

Spencer and also, to some extent, Darwin believed ; but must have had some other origin, and this could only be sought for in the constitution of living matter itself. To show that such an origin is possible, Weismann postulated the existence of ultimate vital units, or biophors, not very different from Spencer's physiological units,—which exhibit all the attributes of life, are capable of multiplication, are of innumerable different kinds, and owe their differences to the fact that they are themselves modifiable by the action of incident forces. A simple unicellular animal or plant, composed as it is of such biophors, would vary in structure owing to the modifications induced in its component biophors, and when it propagates itself by division, its characters would necessarily be handed on to the offspring resulting from division. But in a multicellular animal propagating itself by sexual reproduction, the whole organism is not divided, but only a minute portion is separated, and this portion has the power of giving rise to the whole. This minute portion is a germ-cell, and the biophors of which it is composed must be sufficiently numerous, and of a sufficient different number of kinds, to give rise to all the different tissues and organs of the adult. The germ-cell therefore differs from the tissue cells of the adult, for the latter, as a rule, can only give rise to cells of their own kind, and not to the whole organism, and therefore must contain only special kinds of biophors, and not all the different kinds of biophors necessary for building up the entire organism.

As Darwin's theory of the circulation of gemmules is rejected, for this reason among others, that it involves the acceptance of the inheritance of acquired characters, the observed facts of development can only be explained on the supposition that the body is composed of two kinds of material. The one kind, the germ-plasm, is made up of all the kinds of biophors necessary to produce all the different qualities of the organism ; the other

kind, the somatoplasm, consists of cells in which the different kinds of biophors have been sorted out or *segregated* in exact correspondence, as regards kind and situation, with the various tissues and structures of which the cells are components.

The germ-plasm, on this conception, is the permanent material, in which all the specific characters of the race are collected, and is handed on from generation to generation. The body or soma is, in every generation, the fleeting expression of the qualities contained in the germ-plasm. These qualities are expressed, or made manifest, in the development of every individual from the germ, by the continued segregation of the biophors in the course of cell-division, some kinds passing into one cell, some kinds into another, and this process is repeated at every stage of division until, at last, all the different kinds of biophors are separated into cells or cell-groups, and then give rise to the specific characters which they represent. Their mission is then fulfilled, and, being incapable of further development, they perish in time; but not before the individual has provided for the perpetuation of the race by giving off fresh germ-cells, which are derived from a store of the original germ-plasm reserved, so to speak, during the ontogeny in a special group of cells. These are the outlines of Weismann's theory. I need not pursue it into its intricacies and show how, from a consideration of the fact that every part of an animal is independently variable, and that these variations are heritable, he had to assume that the germ must contain as many biophors as there are different kinds of cell-groups giving rise to independently variable structures, and that these biophors must be grouped into units of a higher order called determinants, and the determinants into yet higher groups called ids, each id containing all the determinants necessary for the formation of an individual and having a definite organization or architecture. Further, that every germ-cell must

contain many different kinds of ids, representing the contributions of many different ancestors. All this would take me far from my main subject, and would require many hours to set forth in sufficient detail.

It is sufficient if I have said enough to show how widely this theory differs from that of Herbert Spencer, and what very different consequences must be deduced from it.

According to Spencer, the material of the germ, out of which the individual is developed, has indeed its own properties which impose a limit upon and determine the general direction of the development; but within these limits the material is highly plastic, and it assumes its ultimate form and qualities in response to external and internal forces acting on it throughout the whole course of ontogeny. The material, being of a certain kind, can only react in a certain way to external and internal forces, and so gives rise to a specific form; but as the forces must always be slightly different, the reactions must always be slightly different, and thus variations arise which are perpetuated in the germ-cells separated off for the maintenance of the race and the building up of the next generation.

According to Weismann and his followers, the material of the germ is already endowed with all the properties of the adult; the development of the individual is pre-determined by the qualities of the germ; the germ-plasm is only slightly plastic, and such changes as are impressed on the soma by the action of incident forces perish with the soma, and are not incorporated into the germ-plasm that is to give rise to future generations.

In the words of Wilhelm Roux, the development of the individual may be likened to a mosaic-work; the substances out of which the picture is to be formed are there beforehand: the picture is formed by sorting out these substances and combining them in a definite order.

If now we inquire into the evidence in favour of one

theory or the other, we find that it is preponderantly in favour of Weismann's.

In the last two decades a large and active school of Experimental Morphology and Embryology has come into existence, whose object it is to inquire into the very problems that we are considering. Started by Oscar Hertwig, Roux, Hans Driesch, Boveri, and many others on the Continent, this method of investigation has been taken up with great enthusiasm in America by E. B. Wilson, Morgan, Jacques Loeb, and many others, but it has as yet made very little progress in this country. In Oxford, however, it has distinguished representatives in the persons of Dr. Vernon and Dr. J. W. Jenkinson, and I hope that in the near future this University will be the English centre of this form of zoological research, which is the complement of that branch of inquiry into the hereditary transmission of structure and characters which has been so firmly established at Cambridge. The first step to be taken by this school of developmental mechanics was a renewed and much more detailed inquiry into the way and course of the development of the germ-cell into the embryo.

The earlier embryologists were contented with saying that the ovum divided into two, the two into four, the four into eight, and so forth. That the cells formed by repeated divisions arranged themselves into a hollow sphere or blastula: that one half of this sphere became tucked into the other half to form a two-layered gastrula, and thus two primary cell layers were formed—an outer and an inner—from which by further differentiation all the organs of the adult were eventually established.

The more modern embryologists go much further than this and trace the exact fate of every cell formed during the division of the ovum. The time and place of origin of every cell is noted, and its subsequent history is followed, until it is satisfactorily proved what part of

the body and what organs and tissues the descendants of that cell give rise to.

It has thus become possible to construct a large number of cell-lineages, each of which can be expressed in the form of a genealogical tree.

The tracing out of cell-lineages is a matter of pure observation, and the whole result of the work has been to show, what might have been predicted from our knowledge of the building up of embryo from the egg and the adult from the embryo by a repeated process of cell-division, that in a normal course of development, particular cells having particular positions in the embryo invariably give rise to the same organs in the larva or in the adult. This observed fact could be interpreted just as well on Herbert Spencer's principles as on Weismann's, for it could be urged that the fate of any particular cell occupying a particular position in the embryo depended, not on any qualities inherent in itself, that is to say on the particular kind of material of which it is composed, but upon the forces to which it is subject, because of its relation to other cells and to the external environment.

But reasoning on the results of simple observation can only lead to hypothetical explanations. Experiment alone can decide the questions at issue. The earliest experiments seemed to support Herbert Spencer's views. Driesch, and after him other investigators, found that, in a number of animals, the first two, or four, or even eight or sixteen, cells formed by the earlier divisions of the germ-cell, might be separated from one another, and that each would, after separation, segment as if it was an entire ovum and give rise to a normal larva, having all the specific characters of a normally developed larva, but of reduced size. O. Hertwig, Driesch, and others showed that the mutual positions of the blastomeres might be altered by pressure and other methods, and yet the altered embryo when released and kept

under ordinary conditions, would develop into a normal larva or adult.

Arguing from these observations, Driesch constructed an epigenetic theory of development not very different from Herbert Spencer's, and laid down the law that the destiny of every cell in the embryo is a function of its position.

But before this Roux had shown that if one of the first two blastomeres of a frog's egg is destroyed, the result is, not the formation of a whole embryo of half size, but a half embryo, and further observation and experiment has shown that in whole classes of the animal kingdom the materials necessary for the formation of the different organs of the larva and adult that is to be are already present and localized in the germ-cell, and are dealt out, according to their kind, at every division from the first onwards.

Here I must digress for a moment to explain that Weismann, agreeing in this matter with Strasburger and O. Hertwig, held it as proved that the biophors and the aggregates of biophors forming determinants, are located in the chromosomes of the nucleus of the germ-cell. This view, supported by a number of considerations, seemed to be amply proved by an experiment of Boveri, who fertilized the anucleate fragments of the eggs of one species of sea-urchin with the sperm of another species, and reared larvae which exhibited the *paternal* characters only. But these results have since been called into question and have quite recently been contradicted by the experiments of Kupelwieser and Loeb, who fertilized the ovum of a sea-urchin with the spermatozoon of a mollusc, and obtained the characteristic larva of the sea-urchin without any trace of paternal characters. And numerous other experiments—too many for me to recount now—have shown that, whatever may be the exact rôle of the nucleus, the cytoplasm of the germ-cell certainly contains organ-forming materials, and that if

these are removed corresponding deficiencies will occur in the larvae reared from the eggs operated upon.

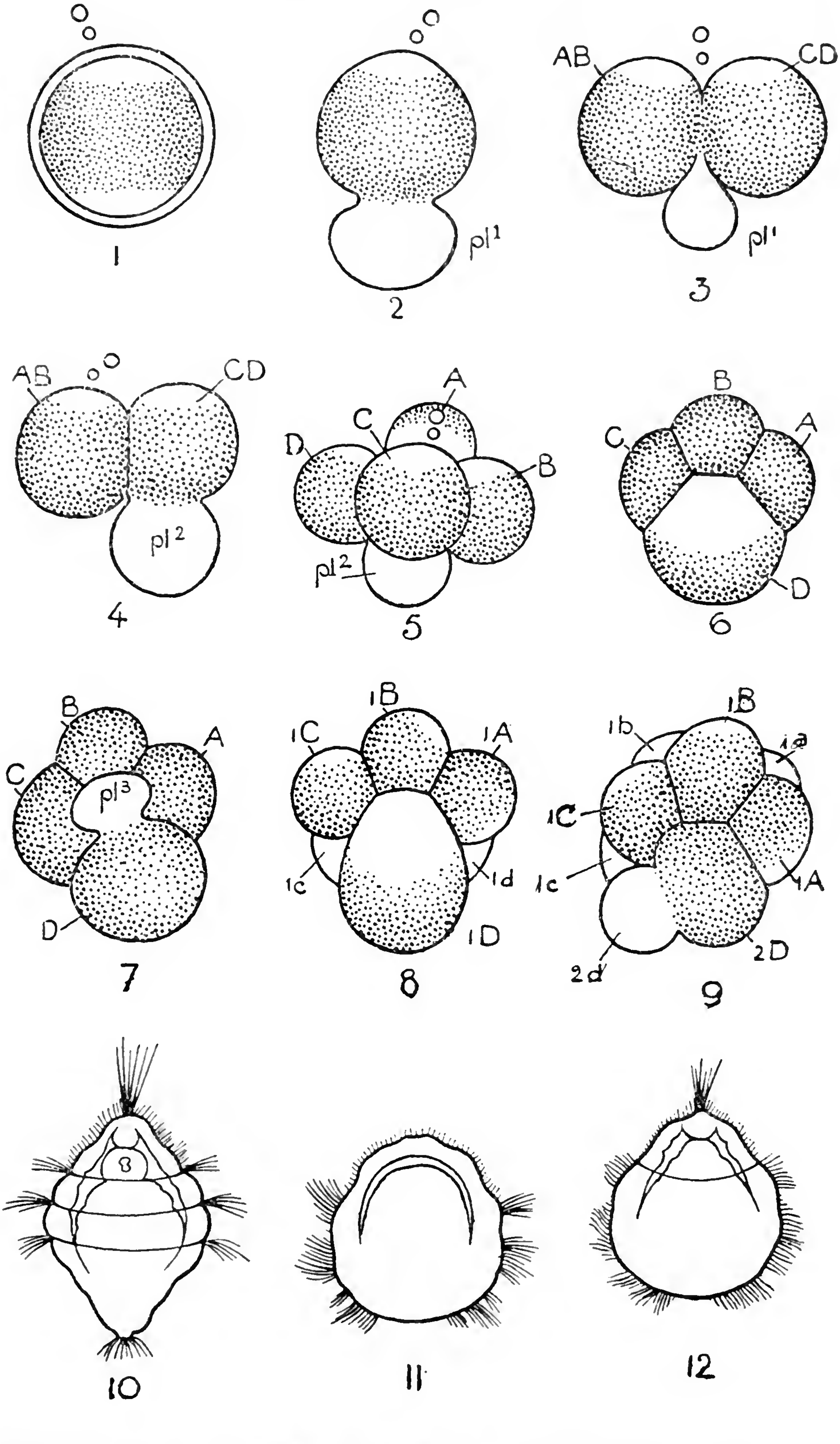
Weismann himself has modified his former opinion, and in his most recent book on the Evolution Theory suggests that particles emitted by the nucleus co-operate with elements already present in the cell-body to give rise to specific tissues. That this must be in some sense true, we are bound to believe from a consideration of many phenomena of cell-division and inheritance, but I will not pursue this subject any further now. I have only introduced it to show that experiment has established beyond all doubt that specific organ-forming substances are present in the cytoplasm of the cell, and the experiment I am going to describe in detail shows that, in a number of cases at least, these substances are dealt out in the course of the division of the germ-cell, just as aces, kings, queens, knaves, &c., held in the hand of the dealer, are dealt out to the different players in a game of cards.

Fig. 1 in the diagram shows a picture of the egg-cell of *Dentalium*, the elephant-tooth-shell. This animal is a mollusc, the representative of the class Scaphopoda, and possessed of many remarkable anatomical features. For the present all that need concern us is, that in the ontogeny of this animal there is a larval form (as indeed is the case in most mollusca), whose shape is shown in Fig. 10. It is shaped something like a humming-top; having three parallel equatorial rings of ciliated cells, dividing an upper from a lower hemisphere. At the summit of the upper hemisphere is an apical organ, consisting of a group of a few cells bearing a tuft of very long cilia. The greater part of the head region and the 'brain' of the adult are formed from this apical organ. The lower hemisphere is at first conical, with a posterior tuft of cilia. Nearly the whole of the body of the adult is formed out of the lower hemisphere and the ciliated rings are provisional organs which become

relatively less and less important and eventually disappear.

In the egg of this animal a broad middle band of red pigment separates a colourless upper polar area from a colourless lower polar area. The lower polar area consists of a dense granular and apparently homogeneous protoplasm in which there are no yolk corpuscles—in this it differs from the rest of the egg.

When the egg is fertilized and about to divide it protrudes from its lower pole a lobe, into which nearly all the white matter of the lower polar area passes (Fig. 2). Division then takes place in such a way that the 'polar lobe' is attached to only one of the two cells formed by the division (Fig. 3). When division is accomplished this 'first polar lobe' is drawn up again into the blastomere to which it is attached. The white polar area is confined to the larger of the two cells. We call the smaller cell *AB*, the larger cell with the white lower polar area *CD*. Before the next division takes place the lower polar area is again extruded in the form of a 'second polar lobe' (Fig. 4). Each blastomere is divided into two, and the second polar lobe remains attached to one of the cell products into which *CD* has divided. We call this product *D*, and the embryo now consists of four cells, *A*, *B*, *C*, *D*. The second polar lobe is once more withdrawn into *D*, but before the third division takes place the white matter is once more extruded as the 'third polar lobe' (Fig. 7). In the third division each of the blastomeres, *A*, *B*, *C*, *D*, divides unequally, giving rise to four smaller cells above which we call 1*a*, 1*b*, 1*c*, 1*d*, and four larger cells below which we call 1*A*, 1*B*, 1*C*, 1*D*. The third polar lobe remains attached to 1*D*, and when division is complete is withdrawn into it. Prior to the fourth division the white material of the third polar lobe moves through the blastomere 1*D* and is mostly aggregated near its upper surface. The fourth division resembles the third, inasmuch as four small cells (micro-



Figures 1-9, early segmentation stages and figures 10-12, normal and abnormal larvae, of *Dentalium*. (After E.B. Wilson)

meres) are formed by the unequal division of the large cells 1*A*, 1*B*, 1*C*, 1*D*. This new 'quartet' of micromeres we call 2*a*, 2*b*, 2*c*, and 2*d*, and it is noticeable that a great part of the white material which formed the third polar lobe passes into 2*d* (Fig. 9). It is known that the products of this particular cell 2*d* form an important part of the ventral surface of the posterior hemisphere of the larva and of the trunk of the adult. Further than this we need not go in the description of the normal course of development.

Now if the first polar lobe be removed, segmentation continues, and ends in the production of a larva such as is shown in Fig. 11. The upper hemisphere and the three ciliated rings of the prototroch are there, but there is no apical organ, and the lower hemisphere is aborted. Such larvae are incapable of further development and soon perish.

It is clear that the material necessary for the formation of the apical organ and the lower hemisphere (that is, the material for the head and trunk of the adult), was contained in the first polar lobe.

If, in another experiment, the second polar lobe is removed, the result is a larva such as is shown in Fig. 12. The apical organ is present, but the lower hemisphere is aborted. Clearly, when the first polar lobe was withdrawn into *CD*, some part of its material, necessary for the formation of the apical organ, must have passed out of the lower hemisphere of that cell, and have been excluded from the second polar lobe—but the trunk-forming material remains in the second polar lobe. Further experiments prove that this is certainly the case, and prove further that the material for the apical lobe is first transferred to *D*, and then at the third division to 1*d*.

For if the blastomeres are isolated, *CD* produces a larva of normal aspect, but of reduced size; *AB* produces a larva similar to that of an ovum from which the first polar lobe was removed.

Isolated A, B, C blastomeres produce defective larvae without apical organ or lower hemisphere. Isolated D larvae are normal, except that the lower hemisphere and apical organ are disproportionately large.

The micromeres 1a, 1b, 1c, 1d may be isolated, and they continue to segment. 1a, 1b, 1c form minute little larvae with a prototroch and an upper hemisphere, but no lower hemisphere, no gut and no apical organ. 1d produces a similar larva as regards absence of trunk and gut, but it has a well-developed apical organ. It is possible to cut eggs of *Dentalium* into two or fertilizable pieces, and to develop larvae from these fertilized fragments. The results are absolutely confirmatory of those I have just described. The lower hemisphere segments as a whole, and produces a dwarfed larva, but with all its parts complete. On the other hand, the upper hemisphere of the egg segments as a whole, but no polar lobe is formed, and the resulting larva has neither apical organ or post trochal lower hemisphere.

Similar and even more thorough and convincing experiments have been made on the developing eggs of the Limpet. But the details are too complicated for me to do more than refer to them. They prove, in an unequivocal manner, that the various cells formed during the cell-lineage, have each a definite and limited destiny and this they will fulfil, even if removed from the aggregate of which they form a part. For example, early in the segmentation certain cells are formed which are destined to give rise to the prototroch. One cell arises in each of the four quadrants formed by the four large cells of the four-cell stage of development, and the cell of each quadrant behaves in the same way. It divides into two and the two divide again into four which combine with the four similar cells derived from each of the other three quadrants to form a ring of sixteen ciliated cells constituting the prototroch. This is the normal course of development. Let us call any one of the primary proto-

troch cells p. It divides into p^1 and p^2, and each of these divides again into p^{11}, p^{12} and p^{21}, p^{22}. If in any embryo p is isolated on its first appearance, it divides twice, and gives rise to four cells each bearing a tuft of cilia. If p^1 and p^2 are isolated, each divides once, giving rise to two cells with a tuft of cilia. If any of the cells p^{11}, p^{12}, p^{21}, p^{22}, is isolated it develops a tuft of cilia, but will not divide. The number of divisions is predetermined, and that number is fulfilled whether the cell remains a part of the aggregate or whether it is removed from it.

The incident forces and the mutual actions and reactions must be very different in the two cases, but the specific number of divisions are gone through and the specific form is attained all the same.

Clearly, in such cases the destiny of a cell is predetermined, and is not a function of its position in the cell aggregate. One cannot say with Driesch 'jeder Theil kann jedes'.

It is, of course, impossible for me to give you a hundredth part of the available evidence; but this much, I think, emerges clearly from what I have told you.

All ova or eggs contain specific substances necessary for the formation of particular regions of the future animal. In the course of segmentation these substances are segregated from one another in a progressive manner, so that in the end particular kinds of substance are isolated in particular cells, derived from division of the original germ-cell. Cell-division therefore, in ontogeny, is the expression of the sorting out and separation of the materials contained in the germ.

This process of segregation sets in earlier in some species than in others. In some cases, as in *Dentalium*, it begins with the very first division of the germ-cell. In other cases the segregation is deferred until a number of cells are present (as is shown by the fact that sometimes any one of the first sixteen blastomeres is capable of

giving rise to entire larvae). But in all cases segregation sets in sooner or later.

If I had the time, and had a great number of diagrams to illustrate my argument, I could prove to you that in any one class of animals such as the Chaetopod worms or the Mollusca, the cell-lineages of different species, though very similar, are never exactly the same. The differences—which may be considerable—are mostly due to the different periods at which special cells, containing particular constituents of the future animal, are formed in the course of segmentation. And I could further show, what I can only now inform you of, that in each class, and in the sub-divisions of each class, there are clear indications that there is a definite relation between the elaboration or simplification of the ontogeny and the period at which the segregation of the specific substances is accomplished in the course of segmentation.

The life-history of an animal may be direct or indirect.

When it is direct, the course of development is straightforward; the animal is hatched out or born with the characters proper to its species. When it is indirect, the animal is born with characters very different from those which it will ultimately assume. It is born as a *larva*, and a typical larva is an independent organism, having means of locomotion, a mouth, and a digestive tract. It feeds itself, lays up a store of nutriment, and only after a longer or shorter period of independent existence does it undergo further developmental changes which lead to the assumption of the adult characters. The caterpillar (larva) and the butterfly (adult or imago) is a familiar example of an indirect course of development.

An indirect course of development is, in a relative sense, prolonged, because there are two free stages and two developmental stages leading up to them to be provided for. If you could suppress the caterpillar stage, the condition of the perfect insect would be arrived at sooner. The development would be abbreviated.

Now in the Chaetopod worms there is a larval stage analogous to that of the caterpillar. We know it as the *trochosphere* larva. It swims about in the sea by means of its ring of cilia; it has rudimentary sense organs; it has a mouth and a complete digestive tract, and it feeds itself. Eventually it gives rise to the adult worm by a process of development which I need not detail now.

But you can see at once that the larva has a specific form and the adult has a specific form, and that the two are very different indeed. Both have to be provided for in the germ-cell which is to give rise to both forms in succession.

When we examine the cell lineage of such a worm as *Polygordius*, it is perfectly clear that the first materials segregated during segmentation are those destined to form the larval organs. While this part of the ontogenetic process is pushed on, the materials for forming the adult organs are held in reserve, and are contained in only a few cells, which do not proceed to further division until the larva is perfected, has fed for some time, and has laid up a provision of nutriment sufficient for the performance of the next phase of development leading to the adult condition.

But in a large number of marine worms a trochosphere larva is produced which does not feed itself. In such cases the egg is provided with a quantity of food material in the shape of yolk granules. During segmentation this yolk is segregated in the large cells of the so-called vegetative hemisphere, from which the digestive tract is ultimately formed. A trochosphere-like larva is arrived at, but it has no functional digestive tract; only an inner mass of large yolk-laden cells, which provide the nutriment necessary for the growth processes. In all such cases adult organs begin to make their appearance early in the ontogeny, and the larval stage is clearly in course of suppression. In consequence, we find that the materials necessary for the formation of adult organs are segregated

earlier in the segmentation phases than is the case in species in which the larva is fully developed and feeds itself. The more the larval stage is obscured, the earlier are the adult constituents segregated during the segmentation of the egg, and the more completely does the development manifest itself as a 'mosaic-work'. In freshwater worms and earthworms there is no larval stage, and here we find that the constituents for the formation of the adult body are segregated at an early period, while those for the formation of larval organs are perhaps indicated, for these worms are descended from marine worms, but as there are no larval organs to be formed the constituents necessary for their formation are never segregated. They have dropped out of the life-history, and cannot any longer be present in the germ, for if they were there they would make their presence manifest in the course of the development.

There is evidence that this process of abbreviation of the development, involving the suppression of the larval stage and the precocious segregation of the factors appropriate to the formation of adult organs, has not occurred once only, but has happened again and again within the limits of the class. Every time that it has happened there must have been some change in the constitution of the germ-plasm; some loss of tendencies to produce larval organs, some hurrying up and strengthening of tendencies to produce adult organs.

Ultimately this hurrying up process, which we call precocious segregation, must affect the germ-cell itself. For in cases where the first two, four, eight, or even sixteen blastomeres are what we call totipotent, in other words, when each contains all the factors necessary to produce the specific structure of the entire organism, there cannot be any pre-localization of the factors in the germ-cell: they must be equally distributed through it. On the other hand, the cases of *Dentalium* and the Limpet—several others could be quoted—show that this

pre-localization may and does exist. From what I have said, I think it is clear that this pre-localization is a secondary and derived condition, not a primary one.

For if it were primary, it would be specially well marked in the eggs of animals which, on other evidence, we regard as primitive, but this is not the case. On the contrary, it is specially well marked in animals which we have every reason to suppose are much modified, either in their larval stages, or in their adult stages, or in both.

If then it is a secondary condition, and if this condition has been acquired several times over, within the limits of a single class, the germ-plasm has been modified and, as far as we can judge, is still undergoing modification in a large number of cases. It is always having the characters, many of them adaptive characters, of the adult thrown back into itself, and conversely, as its constitution is altered, it must reproduce these characters in every somatic generation to which it gives rise.

We are confronted with the old question, as old as the time of Aristotle, whether the egg gives rise to the fowl or the fowl to the egg.

Weismann would answer the question in this way. The germ-plasm is variable, because the biophors composing it are affected by slightly different conditions of nutrition, temperature, &c., and vary. Their variations induce further variations in the determinants, which control the structure of each separately variable part of the organism at all stages of its existence. Therefore the organism varies, and every beneficial variation, at every period of life, will be selected. Natural Selection ensures that only those forms shall survive whose germ-cells contain favourable variations. What is apparent to us is the preservation of favourable modifications in adult (or larval) individuals. What really is preserved is the kind of germ-plasm that has produced those favourable modifications, and as this is handed on from selected

individual to selected individual, any amount of modification is possible, including abbreviation of the ontogeny, the suppression of the larval stages, the precocious segregation of the primary constituents; everything, in short, that is of advantage. I must confess that I am not quite content with this explanation, and there are others who are not content. But I have not the time to criticize it now. To do so requires a full consideration of the supplementary theories of Histonal Selection, Germinal Selection, and Amphimixis, theories not to be lightly treated of or explained in a phrase.

Nor can I offer any explanation of my own of the unquestionable fact that the modification of the germ and the modification of adult structure have proceeded *pari passu*, in the course of phyletic evolution. After struggling for some time with the difficulty, I have come to the conclusion that we must wait for fresh light from the experimental schools of zoology.

For the present, it is enough that we have ample evidence of the pre-existence of 'primary constituents' or 'factors' in the germ.

What the precise nature of these factors may be we are hardly in a position to say at present. But a great deal of light has been thrown on the *behaviour* of these factors by the researches of the Mendelian School of Students of Heredity, at Cambridge. It has been proved that they are resident in the germ-cells, and that they are units, in the sense that they are amenable to the laws of number, and their actions can be represented by simple arithmetical calculations. It has been clearly proved, also, that in respect of any given structure or character in an adult organism, the result manifested is not, in many cases at least, due to the action of a single factor, but to the co-operation of two or more factors. For it has been shown that, for instance, the colour of a sweet-pea is not determined by a single colour-bearing factor, but by the co-operation of two factors. For if

two varieties of sweet-pea both having white flowers are crossed, the resulting generation is all purple. The two white peas are apparently similar, differing only in the shape of their pollen grains. Each kind will breed true for generations, but when crossed they produce the coloured sweet-pea. This coloured form, when self-fertilized, produces several varieties of purples, reds, and whites. I have not the time to explain this phenomenon fully, but may state that analysis showed that the facts are susceptible of the following explanation: One of the original white flowers contained a factor, which we may call *C*, which by itself is incapable of producing colour. The other contained a factor, which we may call *D*, which by itself is incapable of producing colour. But when the two factors are combined, as they are in crossing the two varieties, colour is produced. The subsequent experiments show that it is *red* colour, but the hybrid generation is *purple*. It was shown that this was because one of the original parent whites contained yet another factor *B*, which in the presence of both *C* and *R* produces purple, but does not produce any colour if it meets only *C* or only *R*.

I am informed that it has since been shown that in the case of these sap colours in plants, one at least of the factors has been discovered to be a chemical substance diffused in the sap, but the results have not yet been published.

These discoveries seem to introduce a complication into our conception of factors in the germ-cells, but it seems probable that they will be found quite consistent with the results of experimental work on developing ova, such as I have described. For it has been shown that certain necessary constituents for the production of adult characters are contained in the cytoplasm of the egg. From a large number of considerations we are obliged to conclude that other constituents are contained in the nucleus, and it seems probable that for

many characters it is necessary that the substances contained in the nucleus should act on those contained in the cytoplasm to produce the character in question in the adult, and that it may come about that one or other of these substances is absent and so the character in question is not produced, but will be if the two substances are brought together in fertilization.

But all this is as yet unproved, and it will require years of research to elucidate the many problems presented by the constitution of the germ-cell, and the manner in which organ-producing factors are combined or split up in the course of reproduction.

This much, however, is clear, that Herbert Spencer's conception of the constitution of germ-cells no longer holds good.

The germ is proved to be not a simple relatively homogeneous substance, which acquires increasing heterogeneity in the course of development, but an exceedingly complex heterogeneous substance, containing what, for want of more definite knowledge, we must call *factors*, and these factors are derived by inheritance from germs containing like factors. By intercrossing the factors may be combined, separated, added to, or subtracted, and thus variations of definite kinds may be produced; but the characters to be produced are not determined by the interaction of the constituent parts during the development of the individual, but by the bringing together or separation of the factors during the processes of maturation of the germ-cells and their subsequent union in fertilization.

We conclude that for every species of animals or plants—and by a species we mean a number of individuals capable of interbreeding freely—there is a certain stock of factors which, separately or in combination, are capable of giving rise to all the specific characters, and also to all the varietal characters, manifested by the species. The factors necessary for the production of

the *specific* characters must be present in the germ-plasm of all the individuals composing the species—for if it were not, the specific type would not be produced. But of the factors determining the varietal characters, some may be present in the germ-cells carried by any one individual and some absent. In a mixed race, where the individuals interbreed freely, the combination or separation of the various varietal characters will obey the laws of chance. By studying the segregation of the factors in the course of two or three generations of selective breeding, a pure race, true to certain characters may be established, and the advantageous characters of two or three different races may be combined. Improvement may be effected in this way, but in no case can it be secured by the selection of such modifications as have been produced in the individual by the direct action of external agencies, whatever these agencies may be. When once particular factors are brought together by the union of germ-cell with germ-cell in fertilization, the characters of the adult, including habit as well as form and colour, are irrevocably fixed, as are also the qualities which the adult in question can transmit to its descendants. This being the case, one of the most important links in the chain of argument used in the synthetic philosophy is broken, and the sociological conclusions founded upon the biological principles set forth in that system are vitiated.

But, although I do not think that we can any longer accept Herbert Spencer's conclusions, we should hold fast to his conviction that mankind is governed by the same laws as govern the animal kingdom, and that no true system of sociology can be offered which does not take full account of those laws.

It is not the business of a zoologist to offer solutions of social questions. But he is within his right if he tenders to those whose business it is to study these questions such evidence as is relevant.

Molluscs and marine worms and sweet-peas may seem to be remote from human institutions, and it may be objected that conclusions derived from biological studies of this kind cannot be applicable to ourselves. But this objection does not hold good. The phenomena of heredity and variation in mankind, as well as the physiology of man, have been studied in greater detail than in any animal, and we have ample evidence that man is as inexorably subject to the same fundamental laws of existence as are animals. And since many of the most important of human institutions are closely bound up with these fundamental laws, when we attempt by legislation or influence or education to vary our institutions in the hope of improving our present condition and transmitting the improvement to our successors, it is imperative that we should act in accordance with and not contrary to those laws.

You will probably be inclined to the opinion that the conclusions to which zoology has arrived are not sufficiently secure to warrant an attempt to apply them to affairs of state. Be it so. But it is a fact commonly overlooked that ideas derived from biological science *are* being applied to the affairs of the state, and that some who would hurry on the march of progress wish, consciously or unconsciously, to apply them still further. But these ideas are founded on the conclusions reached fifty years ago, and science has moved far forward since then. It is to be feared that much that still passes for ' progress ' is really regress, for it is founded on mistaken conceptions of the operations of Nature.

Vague as some of our conceptions still are of the operation of the forces underlying vital phenomena, I think that we are clear on one point, which I have already emphasized, that man, in common with his fellow creatures, has a past history which he cannot divest himself of. And not only man as a species, but man as an individual, for he is born with certain charac-

teristics, and he can only hand on those characteristics to his children. Hygiene, education, social institutions, may improve the lot of the individual, but they cannot produce any permanent effect on the race. And many of our apparently most promising reforms may actually do injury to the race, if they result in the multiplication of the unfit at the expense of the fit—fitness and unfitness being innate and not acquired characters.

But I will not pursue this subject further. If you ask me to point out the way, I am excused from the necessity of doing so, for it was pointed out by Sir Francis Galton in the Herbert Spencer lecture in 1907. It is sufficient if I have made it evident that zoological studies have a human interest and a human application. They are difficult studies, and they do not obviously lead to material prosperity, so they attract but little interest in this country, and I think it is a reproach to us. Perhaps we zoologists are responsible for it, for we are wont to conceal our results in language that is not understanded of the people. I have tried this afternoon to tell some of the most important conclusions of my science in plain language, and hope that I may have attracted your interest.

I will conclude by saying that, though I have been at trouble to show that some of the most important parts of his *Principles of Biology* were founded on erroneous data, I recognize with gratitude that the far-reaching importance of biological study was not only appreciated but strenuously advocated to the last by Herbert Spencer.

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EVOLUTION

DARWINIAN AND SPENCERIAN

THE HERBERT SPENCER LECTURE

DELIVERED AT THE MUSEUM
8 DECEMBER 1910

BY

RAPHAEL MELDOLA, F.R.S.

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EVOLUTION: DARWINIAN AND SPENCERIAN

'For certain it is that God worketh nothing in Nature but by second causes; and if they would have it otherwise believed, it is mere imposture, as it were in favour towards God; and nothing else but to offer to the Author of Truth the unclean sacrifice of a lie.'

BACON, *Advancement of Learning*, Book I.

AMONG the great generalizations of the mid-Victorian era—that period which has witnessed such enormous advances in every department of natural science—the doctrine of Evolution stands out pre-eminently. With the foundation of that doctrine the names of our two great countrymen, Charles Darwin and Herbert Spencer, are indissolubly associated. The acceptance by this ancient University of a lectureship bearing the name of one of the founders of the modern doctrine is a sign of the times of the deepest significance in the intellectual development of this country. The century of Darwin's birth and the fiftieth year of the publication of the *Origin of Species* were celebrated here and at Cambridge last year; the tributes paid to his memory on those occasions are still fresh in our minds. Throughout the international chorus of admiration for the work of our great naturalist there rings out one clear note proclaiming that the method of viewing the process of organic development made known by Darwin and Wallace marked the beginning of a new epoch in human thought.

The history of evolutionary ideas in general, and of the special form of organic evolution associated with the names of Darwin and Wallace, has been fully dealt with by many able writers. It may be difficult to place the subject in any new light; nevertheless, on the present

occasion, the year following the Darwinian celebrations, it seemed not inappropriate that I should endeavour to institute a comparison between the methods of the two great founders of the modern school of Evolution—to trace the impression left by each upon current thought and to attempt an analysis of the causes which have determined their respective influences.

At the outset, and in order to bring the subject within reasonable limits, let it be understood that, having no claim to have been a student of Philosophy in the special sense, I propose restricting the treatment mainly to the scientific aspect of the writings of Darwin and Spencer. It may further be useful, in view of the widespread popular belief that Evolution and Darwinism are synonymous, to insist once more upon the fact that Darwin and Wallace gave us a theory of organic development which Spencer incorporated in that general scheme of Evolution which he had independently elaborated. It is perhaps scarcely necessary to add that Evolution as a philosophical principle does not stand or fall with the proof or disproof of Natural Selection as a theory of species formation.

Both Darwin and Spencer have, fortunately for posterity, left a complete record of the development of the evolutionary idea in their own minds, so that full details of the various stages are now unnecessary. It will be sufficient for the present purpose if I select a few dates marking the more conspicuous phases. During the voyage of the *Beagle* Darwin had considered the possible mutability of species, partly as the result of his own observations and partly as the result of the discussion of the question in Lyell's *Principles of Geology*. His first systematic note-book on this subject was opened in 1837, after his return to England. In 1838—a memorable epoch for natural science—the theory of Natural Selection was conceived as the result of his perusal of Malthus *On Population*. The first rough draft of his views was prepared in 1842, and this, thanks to his son, Dr. Francis Darwin,

we now possess in a permanent form. The first draft was copied and enlarged in 1844, and the larger and more comprehensive work was commenced twelve years later, viz. in 1856. The first public declaration of his views was made—as he thought prematurely—in 1858, owing to the independent discovery of the principle of Natural Selection by Alfred Russel Wallace. The history of this splendid example of scientific magnanimity is well known, but cannot be too often referred to as a pattern of chivalry and of intellectual greatness for the guidance and encouragement of the younger generations. The first edition of the *Origin of Species* was published on November 24, 1859.

During the Darwinian celebration here last year it was claimed that through Lyell, who was a pupil of Buckland's, Oxford had some influence in moulding the career of Charles Darwin, whose indebtedness to the illustrious pioneer of modern Geology is notorious. Such influence as Buckland had in forming Lyell's geological views was, however, of a negative rather than of a positive character, for the pupil's reputation was ultimately made by overthrowing the teaching of his master. In a similarly indirect way, and also through Lyell, Oxford may be said to have influenced Herbert Spencer, since he first read the *Principles of Geology* in 1840, when twenty years old, and the arguments advanced in the early editions of that work *against* Lamarck's theory of animal development led him, as he has told us in his *Autobiography*, to ' a partial acceptance of Lamarck's views '.[1] In a more direct way may Oxford claim also to have influenced Spencer, since Dean Mansel, the author of those well-known Bampton Lectures so freely quoted in the *First Principles*, was a distinguished member of this University. Whether Spencer's early acceptance of Lamarckism is responsible for his later tenacity in combating the views of that school of biologists founded by Weismann is a point which might serve for academic discussion, but whatever

[1] See also the ' Filiation of Ideas ' in Duncan's *Life and Letters*, p. 536.

view may be held concerning his attitude with respect to this question, there can be no doubt that his mind was given a bias towards development as a principle at this early stage in his career. Through all his subsequent writings the underlying idea of development can be traced with increasing depth and breadth, expanding in 1850 in his *Social Statics* to a foreshadowing of the general doctrine of Evolution.[1] In 1852 his views on organic evolution had become so definite that he gave public expression to them in that well-known and powerful essay on *The Development Hypothesis*, first published in *The Leader*. In the *Principles of Psychology*, the first edition of which was published in 1855, the evolutionary principle was dominant. By 1858—the year of the announcement of Natural Selection by Darwin and Wallace—he had conceived the general scheme and had sketched out the first draft of the prospectus of the *Synthetic Philosophy*, the final and amended syllabus having been issued in 1860. The work of Darwin and Spencer from that period, although moving along independent lines, was directed towards the same end, notwithstanding the diversity of the materials which they made use of and the differences in their methods of attack ; that end was the establishment of Evolution as a great natural principle or law.

This very brief epitome will make it clear that as an Evolutionist Spencer stands in an absolutely independent position. Up to the period of the publication of the *Origin of Species* and the conception of the scheme of the *Synthetic Philosophy* there had been no contact of thought between the two founders of the new doctrine beyond the presentation by Spencer of a copy of his Essays to Darwin in 1858, which present was duly acknowledged and, apparently, in such laudatory terms that Spencer has withheld the letter from publication.[2] He was absent from London on that memorable 1st of July, 1858, when the papers of

[1] 'Filiation of Ideas,' p. 541.
[2] See Darwin's *Life and Letters*, vol. ii, p. 141.

Darwin and Wallace were communicated to the Linnean Society.[1] But it is of interest to note that Spencer himself, as in the case of certain other pre-Darwinian writers, had come very near the conception of Natural Selection without grasping its full significance. In the *Westminster Review* for April, 1852, there appeared an article on a 'Theory of Population', in which occurs the following idea, afterwards transferred to the *Principles of Biology*:—

'And here, indeed, without further illustration, it will be seen that premature death, under all its forms and from all its causes, cannot fail to work in the same direction. For as those prematurely carried off must, in the average of cases be those in whom the power of self-preservation is the least, it unavoidably follows that those left behind to continue the race must be those in whom the power of self-preservation is the greatest—must be the select of their generation. So that whether the dangers of existence be of the kind produced by excess of fertility, or of any other kind, it is clear that by the ceaseless exercise of the faculties needed to contend with them, and by the death of all men who fail to contend with them successfully, there is ensured a constant progress towards a higher degree of skill, intelligence, and self-regulation—a better co-ordination of actions—a more complete life.'

The effect of the publication of the *Origin of Species* upon the mind of an Evolutionist of such pronounced views as Spencer is an interesting episode in the history of his work. With scientific candour he at once admitted the cogency of Natural Selection. Up to that time organic evolution had been for him, tacitly if not avowedly, Lamarckism—the only mechanism of development then known.[2] The Darwin-Wallace factor was thereafter given its proper function in the process of evolution—not to the exclusion of Lamarckism, but side by side therewith as an efficient cause of modification. The precise terms of his acceptance of the new view of species formation have

[1] *Autobiography*, vol. iii, p. 27.

[2] Buffon's 'direct action of environment' is included under this term.

been recorded in the *Autobiography* and elsewhere, and are of importance from the present point of view because he has himself explained his failure to realize the full significance of this factor which he came so nearly discovering in 1852. Referring to the passage quoted above from his *Westminster Review* article of that date, he says:—

'This paragraph shows how near one may be to a great generalization without seeing it. Though the process of Natural Selection is recognized, and though it is ascribed a share in the evolution of a higher type, yet the conception must not be confounded with that which Mr. Darwin has worked out with such wonderful skill, and supported by such vast stores of knowledge. In the first place, Natural Selection is here described only as furthering direct adaptation—only as aiding progress by the preservation of individuals in whom functionally produced modifications have gone on most favourably. In the second place, there is no trace of the idea that Natural Selection may, by co-operation with the cause assigned, or with other causes, produce *divergence* of structure; and of course, in the absence of this idea, there is no implication even that Natural Selection has anything to do with the origin of species. And, in the third place, the all-important factor of variation—"spontaneous" or incidental as we may otherwise call it—is wholly ignored. Though use and disuse are, I think, much more potent causes of organic modification than Mr. Darwin supposes—though, while pursuing the inquiry in detail, I have been led to believe that direct equilibration has played a more active part even than I had myself at one time thought, yet I hold Mr. Darwin to have shown beyond question that a great part of the facts—perhaps the greater part—are explicable only as resulting from the survival of individuals which have deviated in some indirectly-caused way from ancestral type. Thus the above paragraph contains merely a passing recognition of the selective process, and indicates no suspicion of the enormous range of its effects, or of the conditions under which a large part of its effects are produced.'[1]

Still more explicit in the description of his attitude towards Natural Selection are the following extracts from

[1] *Principles of Biology*, 1867, p. 500, note.

his *Autobiography* in which, with reference to the same article of 1852, he says :—

'It seems strange that, having long entertained a belief in the development of species through the operation of natural causes, I should have failed to see that the truth indicated [in the article quoted] must hold, not of mankind only, but of all animals, and must everywhere be working changes among them. If when human beings are subjected by pressure of population to a competition for the means of subsistence, it results that on the average the tendency is for the select of their generation to survive, so, little by little, producing a better adapted type, then the like must happen with every other kind of living thing similarly subjected to the "struggle for existence". And if so, this must be in all cases a cause for modification. Yet I completely overlooked this obvious corollary—was blind to the fact that here was a universally-operative factor in the development of species. There were, I think, two causes for this oversight.

'One was my espousal of the belief that the inheritance of functionally produced modifications suffices to explain the facts. Recognizing this as a sufficient cause for many orders of changes in organisms, I concluded that it was a sufficient cause for all orders of change. There are, it is true, various phenomena which did not seem reconcilable with this conclusion ; but I lived in the faith that some way of accounting for them would eventually be found. Had I looked more carefully into the evidence and observed how multitudinous these inexplicable facts are—had I not slurred over the difficulties, but deliberately contemplated them, I might perhaps have seen that here was the additional factor wanted.

'A further cause was that I knew little or nothing about the phenomena of variation. Though aware that deviations of structure, in most cases scarcely appreciable but occasionally constituting monstrosities, occur among all organisms, yet I had never been led to think about them. Hence there lacked an indispensable idea. Even had I become distinctly conscious that the principle of the survival of the select must hold of all species, and tend to modify them, yet, not recognizing the universal tendency to vary in structure, I should have failed to recognize a chief reason why divergence and re-divergence must

everywhere go on—why there must arise multitudinous differences of species otherwise inexplicable.'[1]

Again, referring to the state of his belief prior to the enunciation of the theory of Natural Selection, he states that before that period he was wholly Lamarckian :—

'I held that the sole cause of organic evolution is the inheritance of functionally produced modifications. The *Origin of Species* made it clear to me that I was wrong, and that the larger part of the facts cannot be due to any such cause.'[2]

He goes on to say that any annoyance he may have felt at having missed this great principle in 1852 was overwhelmed by his satisfaction at having the theory of organic evolution so completely justified, and thus giving support to that more general doctrine which he was advocating.

The effect of the Darwinian factor upon Spencer's views is amply set forth in the foregoing extracts. There is a touch of the true scientific spirit about these admissions which cannot but add lustre to the personality of the author of the *Synthetic Philosophy*, of whom Huxley said that outside the rank of biologists he (Spencer) was the only man known to him 'whose knowledge and capacity compelled respect, and who was, at the same time, a thorough-going Evolutionist' when Darwin's great work was published.[3] Whether Spencer's writings, without the impetus given to evolutionary thought by Darwin and Wallace, would have converted the scientific world is a question upon which we, who have become Evolutionists in post-Darwinian times, can hardly form a just opinion. Judging from the storm of opposition which Darwin's views at first met with among scientific men, it may,

[1] Op. cit., vol. i, p. 388 et seq.

[2] Ibid., vol. ii, p. 49. Also 'Filiation of Ideas' in Duncan's *Life and Letters*, p. 540. In a letter to Sir Edward Fry written in 1894, he again admits that in his pre-Darwinian writings he ascribed too much to the inheritance of 'functionally produced modifications'; Duncan, ibid., p. 351.

[3] Darwin's *Life and Letters*, vol. ii, p. 188.

however, be surmised that Spencer's treatment, however powerful, would not have carried the naturalists of that period much beyond the Lamarckian position. If a theory of organic evolution in which a true working mechanism had been suggested failed to carry conviction to scientific workers, still less is it likely that any effect would have been produced by a theory which assumed an inadequate mechanism. Huxley, who was on terms of personal friendship with Spencer, has told us that he remained unconvinced until the enunciation of the Darwinian theory :—

'I took my stand upon two grounds : firstly, that, up to that time, the evidence in favour of transmutation was wholly insufficient ; and, secondly, that no suggestion respecting the causes of the transmutation assumed, which had been made, was in any way adequate to explain the phenomena. Looking back at the state of knowledge at that time, I really do not see that any other conclusion was justifiable.' [1]

At this stage in the history of Evolution it becomes more distinctly evident that Darwin and Spencer had approached the subject with different types of mind, and were, so to speak, addressing different audiences. Both had set out from data furnished by living organisms, his observations upon geographical distribution and geological succession having first led Darwin to question the current belief in the immutability of species. Spencer had taken for his raw material the super-organic phenomena resulting from the complex activities displayed by human aggregates. From the time of their public advocacy of Evolution as a principle the two pioneers also pursued different paths. The first volume of the Synthetic Philosophy, *First Principles*, was published in 1862, and the revised edition in 1867. The first volume of the first edition of the *Principles of Biology*, the work which might naturally be expected to bring into most intimate comparison the methods of the two founders,

[1] Darwin's *Life and Letters*, vol. ii, p. 188.

was published in 1864, and the second volume in 1867. By that time the *Origin of Species* had been before the public for eight years, and the Darwinian principle of selection had become an integral part of Spencer's mechanism of organic evolution. He was, in fact, so far as concerns the species question, an orthodox Darwinian who gave somewhat more weight to the Lamarckian factors than Darwin himself. The term 'survival of the fittest', approved by both Darwin and Wallace as an alternative for 'Natural selection', was, as is well known, introduced by Herbert Spencer.[1]

Whether for acquiescence or for disagreement there is no doubt that both public and scientific discussion concentrated itself mainly upon Darwin's writings, and that the fame of his illustrious contemporary was, so far as he handled biological questions, temporarily eclipsed by the brilliant demonstrations of 'descent with modification' which the author of the *Origin* had marshalled in his classical work. My own case is, I imagine, typical of the general attitude of the younger school of naturalists of that period. We had read the *Origin of Species* and had mastered—or thought we had mastered—the views of its author. With no very strong prepossession in favour of the orthodox view of species formation by special creation, we required but little persuasion to convert us into Evolutionists. If any feeling of astonishment arose it was that such simple and effective causes and such conclusive reasoning as was contained in Darwin's work should have given rise to any controversy at all. Herbert Spencer was to most of us a name of which we had heard vaguely, but which had, as we thought—I refer to the late sixties and early seventies—no special connexion with natural science. It must be frankly admitted that many, if not the majority, of students of that period were

[1] See 'Filiation of Ideas', p. 559. Also Wallace to Darwin, 1866, *More Letters*, vol. i, p. 268, and Darwin to Wallace in 1866. Ibid., p. 270.

introduced to Spencer through Darwin. Such of us as ventured to read the *First Principles* then learnt that the theory of organic evolution propounded in the *Origin of Species* was the application to one domain of Nature of a broader principle which Spencer had shown held good throughout every domain of Nature ; that organic evolution by Natural Selection was a particular phase of the evolutionary process. Whatever might be the special mechanism which had given rise to particular lines of development among the various groups of natural phenomena, the principle that development there had been throughout the past, that development was going on at the present time, and that development would go on in the future was brought home by Spencer's treatment in a way that could not fail to leave a lasting impression upon minds still in the plastic stage of studentship. In brief, it was to Spencer that we were indebted for the expansion and consolidation of our ideas of Evolution, and speaking now, after an interval of some forty years, I see no reason for modifying this general impression, even if we have since, with the progress of knowledge, found reasons for dissenting from some of his views. The points on which many modern workers have departed from the teaching of the author of the *Synthetic Philosophy*—even if they should prove to be altogether right and Spencer altogether wrong—are, in fact, in relation to the general doctrine, but minor points affecting the special mechanism of evolution in particular classes of cases. The broad principle remains unshaken, and Spencer is unquestionably the thinker whose name will go down to posterity as *par excellence* the Philosopher of Evolution of the nineteenth century.

In stating that the writings of Darwin were of paramount influence in moulding public and scientific opinion it must not be concluded that Spencer exerted no influence or that his treatment of Evolution was considered inadequate in the early days of the doctrine. Such differences in impressing their contemporaries as are known to have

existed are, from an abstract point of view, no more than an expression of the public attitude towards Science and Philosophy respectively. Spencer would have been read and his fame established even if the principle of Selection had not been discovered in his time. It must not be forgotten that this Darwinian principle has as yet been conclusively shown to hold good only in the world of life. How far it can be legitimately extended, whether it can indeed be extended at all into the domain of inorganic nature, is a matter for future decision. But we are now prepared for Evolution in every domain; perhaps it is not going too far to say that both Science and Philosophy have accepted Evolution as a faith—it is for Science to determine the *modus operandi* in each particular domain. It will be remembered that, as in the case of most great generalizations, thought had been moving in this direction for many years before Spencer definitely formulated the doctrine. Lamarck and Buffon had suggested a definite mechanism of organic development, Kant and Laplace had suggested a principle of celestial evolution, while Lyell had placed geology upon an evolutionary basis. The principle of Continuity was beginning to be recognized in physical science by those who, like Herschel, Mary Somerville—a name perpetuated by this University—and Grove, had approached the subject from the inorganic side. 'The correlation of the physical forces'—to use Grove's title—was the qualitative predecessor of that quantitative doctrine which in the hands of Mayer, Helmholtz, Joule, and William Thomson, afterwards Lord Kelvin, culminated in the great generalization now known as the Conservation of Energy. It was Spencer who brought these independent lines of thought to a focus, and who was the first to make any systematic attempt to show that the law of development expressed in its widest and most abstract form was universally followed throughout cosmical processes, inorganic, organic, and superorganic.[1]

[1] In 1860, when returning the proofs of the *First Principles*, Huxley

The distinction between Evolution and Darwinism, although constantly pointed out, still seems to me to require emphasizing—not only in justice to Spencer, but also with a view to stimulate further inquiry into the possibility of extending the Darwinian principle of Selection or Survival to departments of Evolution to which it has not yet been applied. For example, a most highly suggestive hypothesis applying the principle of the survival of stable mechanical systems of corpuscles or electrons to the evolution of the atoms of the chemical elements was advanced by Sir George Darwin in 1905.[1]

Strictly and equitably considered it must be admitted that Darwin's influence upon those fields of Evolution in which the principle of Selection does not or has not yet been proved to hold good has been of an indirect character. I venture to think that an impartial consideration of the achievements of the two great pioneers is hardly possible now, for their work has been accomplished so near our own times that we are as yet unable to obtain a correct perspective view of their relative positions. In what may be called non-selectional Evolution, Spencer must certainly be credited with as much direct influence as was produced by Darwin upon organic Evolution, although of course the possibility must always be borne in mind

wrote to Spencer : 'I rejoice that you have made a beginning, and such a beginning—for the more I think about it the more important it seems to me that somebody should think out into a connected system the loose notions that are floating about more or less distinctly in all the best minds. It seems as if all the thoughts in what you have written were my own, and yet I am conscious of the enormous difference your presentation of them makes in my intellectual state. One is thought in the state of hemp yarn, and the other in the state of rope. Work away then excellent rope-maker. . . .' *Life and Letters of Huxley*, vol. i, p. 213.

[1] *British Assoc. Rep. South Africa*, 1905, pp. 10–14. Crookes also, in his Presidential Address to Sect. B of the British Association at Birmingham in 1886, advanced arguments in favour of the evolution of the chemical elements from 'protyle', but no mechanism was suggested. Lockyer has marshalled the astro-physical evidence in his work on 'Inorganic Evolution', 1900.

that what is apparently non-selectional Evolution may hereafter be shown to be strictly Darwinian.

This last point is of such fundamental importance in relation to those border subjects where physical and biological science meet, that no excuse need be offered for inviting its fuller discussion. In the domain of chemistry, for example, I have often pondered the question whether some principle of Selection or Survival may not be applicable to the case of the synthesis of organic (i.e. carbon) compounds, many thousands of which are now known to chemists.[1] The special interest attaching to these compounds from the present point of view is of course their relationship to the lowest form of living matter. The great majority of these compounds are purely artificial, i.e. they are laboratory preparations which are unknown as products of vital activity. But great as have been the achievements of chemists in the way of producing new compounds, it is becoming more and more evident that from a scientific point of view negative results may be as important as positive results. In other words, with the progress of knowledge it is becoming apparent that the possibilities of developing new atomic groupings are subject to definite limitations.

This is expressed in modern terms by saying that certain configurations of atoms are possible and others impossible. Although tentative hypotheses connecting the stability of certain types of compounds with particular configurations have been suggested, it must be confessed that our knowledge is still in an empirical stage. We cannot deduce from known data with any degree of precision why the possibilities of synthesis are restricted in this, that, or the other direction. It may be said in a general way that the stability of any atomic system must be ultimately explicable in mechanical or dynamical terms, and that the greatest future development of our science may therefore

[1] The new edition of Richter's *Lexikon* proposes cataloguing 150,000 formulae.

be looked for from the co-operation of the chemist and physicist.

From the evolutionary standpoint may not a chemical compound be regarded as the analogue of a biological 'species'? The chemist may be looked upon as a selecting agent acting in the present state of knowledge as a more or less unconscious agent. He is as dependent for his 'species' upon intra-molecular dynamical conditions as is natural or artificial selection upon the congenital variations offered by the living organism. Moreover, the compounds which he isolates are adaptations to a particular environment—they consist of molecules capable of existence only under the particular environmental conditions imposed. Change the conditions, such for example as by raising the temperature, and a different order of chemical combination becomes possible. Out of various possible combinations of particular atoms in particular ways the chemist therefore can only produce such compounds as are capable of survival under his laboratory conditions. The 'fittest' that here survives is the product of chemical skill only in the same sense that a race is the product of artificial selection, or a species the product of natural selection. Darwin's prime conditions of organic evolution—the nature of the organism and the nature of the environment—are complied with if for 'organism' we substitute 'atomic configuration', and if by 'environment' we mean physical and chemical environment. The analogy between a chemical compound and a species is also borne out by the circumstance that in reaching the final stage intermediate unstable stages are frequently if not generally passed through—the 'unfit' with respect to the final environmental conditions. Furthermore, in some cases the internal mechanism is so evenly balanced that the final product may be said to possess a power of responsivity, being capable of existing in one or another of certain distinct modifications according to its chemical or physical environment. This is what chemists know as 'tautomerism', 'dynamical isomerism',

&c. The biological analogue of this phenomenon is the power or faculty of adaptability to a variable environment displayed by living organisms.

If this analogy be conceded—and I do not think it is overstrained—it must hold good for that primordial synthesis of organic (i.e. carbon) compounds from which were developed the simplest compounds possessing those characters associated with the term 'vitality', at this stage in its most rudimentary form. On a globe cooling down from an igneous condition many such syntheses would become possible. The conditions of survival would be of precisely the same kind, if different in degree, as those which determine laboratory syntheses of the same pyrogenic order. Most Evolutionists believe that the gap between the simpler synthetical carbon compounds and the simplest form of 'vitalized' (i. e. 'organized') carbon compound has been bridged over by natural processes.[1]

[1] On this point see Spencer's *Principles of Biology*, vol. i, chap. i and appendix; Darwin to Carus in 1866, *More Letters*, vol. i, p. 273; Huxley's Presidential Address to the British Association, Liverpool, 1870; Darwin to Mackintosh, 1882, *More Letters*, vol. ii, p. 171; Ray Lankester on 'Protoplasm', *Encycl. Brit.*; the writer's Address to the Essex Field Club on 'Darwin and Modern Evolution', in 1883; *Transactions* of the Club for that year; Karl Pearson, *The Grammar of Science*, 2nd ed., chap. ix. Also Professor Sorley's recent paper 'The Interpretation of Evolution', *Proc. Brit. Acad.*, vol. iv, 1909. The theory of 'panspermia' (see *Worlds in the Making*, by Arrhenius, chap. viii) postulates the existence of eternal and universally distributed life germs ready to develop whenever placed under favourable conditions. This hypothesis shelves the question of the possible origin of those particular chemical compounds of carbon and other elements associated with life as we know it—and no other form of life comes under consideration—and relegates these compounds to the 'Ultimates' with Energy and Matter. The history of science, however, shows how dangerous it is to brush aside mysteries, i. e. unsolved problems, and to interpose the barrier placarded 'eternal—no thoroughfare!' Not long ago the chemical atom was considered to be eternal, and attempts to arrive at a knowledge of its origin were regarded as futile. The chemical atom at that stage of scientific development was an 'Ultimate'. From later physical research we now learn that not only is the atom not eternal, but that we are likely to know more about its inner mechanism and the causes of its mortality than about the atom itself as a concrete particle. Such being the state of modern science with respect to comparatively simple particles, it may reason-

Of these processes—whether they were thermosynthetic, electrosynthetic, or photosynthetic, or the result of the interaction of any other form of energy and matter—we are at present profoundly ignorant. But it is known that for the display of 'vitality' in its simplest manifestation certain chemical combinations are essential. It is perhaps unnecessary to raise the question whether 'vitality' is simply the manifestation of the properties pertaining to particular combinations of atoms or the result of some power conferred by extraneous agency upon certain special chemical compounds. Evolution has answered this question over and over again in unequivocal terms—the invocation of extraneous 'powers' to explain processes of which we are ignorant is simply the re-introduction of long-abandoned unscientific methods.

The question now raised is the more specific one of evolutionary process. Granting the analogy between chemical compounds and species, it may be asked whether the development of the simplest living form of matter can be conceived in Darwinian terms. The survival of a chemical compound, as such, is made possible by the nature of the internal mechanism of the molecule, whether that molecule contains carbon, hydrogen, nitrogen, &c., in atomic groupings capable of manifesting 'vitality' or not. So far the principle of survival holds good. The problem that confronts the Evolutionist is the nature of the mechanism which rendered possible the persistence of a certain compound or of certain compounds possessing

ably be contended that a complex of many atoms, such as exists in the very simplest known or conceivable living germ, is still more unlikely to be possessed of immortality. If the idea of immortality is eliminated from 'panspermia' we are left in possession of the hypothesis that space may be crowded with life germs partly of terrestrial and partly of cosmic origin. Of this conception all that can be said is that it may be true, but that the question of the possible development of living from lifeless carbon compounds is left precisely where it was before. From the point of view of Evolution it is quite as reasonable to postulate the continuous and present development of these ultra-microscopic life germs here or elsewhere throughout the Universe—to erect in fact a new theory of 'Pangenesis' in a sense quite different to that used by Darwin in his celebrated 'provisional hypothesis'.

that particular constitution conferring upon them that stable instability known as life. If selection there has been, it may safely be asserted that the agency was physical, i.e. the inorganic environment. During that period—probably extending over geological ages—when lifeless carbon compounds were giving rise to living carbon compounds there can have been no struggle for life with competing organisms. The survival of the simplest types of living carbon compounds may thus be as referable to chemical constitution as the isolability of a definite synthetical compound. From this point of view the question that has to be answered is, what particular atomic configuration or configurations potentially vitalizable were capable of existence under the environmental conditions of that remote past ?[1] Given such compounds, and the subsequent course of organic evolution by the Darwinian process becomes intelligible.

The physical condition which in one direction limits the existence of such compounds is, of course, temperature. The chemical condition requires an atomic grouping of sufficient stability to exist as a definite molecule or molecular aggregate, and of sufficient instability, i.e. internal mobility, to resist destructive physical and chemical processes. In other words the compound must be possessed of the faculty of 'responsivity' with respect to its environment.[2] It would be rash to attempt to

[1] This assumes that the passage from lifeless to living matter took place only during past ages and is not taking place now. See, *per contra*, note, p. 18. The supposition that life germs may be developing now, here or elsewhere, makes no difference to the above statement of the question excepting the substitution of 'are' for 'were' and 'present' for 'remote past'.

[2] The word environment is here used in its widest possible sense as including the vital processes of assimilation and growth, in their initial stages. For growth may be regarded as the result of the addition of one carbon compound to another with which it is capable of combining by virtue of its chemical constitution, i.e. assimilation as the result of the action of one carbon compound upon another—the interaction of an organic environment and a responsive organic compound. Reproduction, as Spencer has shown, follows from growth. The term 'mobility' is used above in its chemical sense as referring to intra-

predict whether such compounds will ever be synthesized in our laboratories, but the analogy which has been made use of throughout this discussion may be of use here. It may even be permissible to go further and to suggest that the analogy which it has been attempted to establish between an organism and a chemical molecule, in the initial stages of 'vitality' passes from an analogy into a physical reality. The nearest approach to responsivity which modern chemistry can offer is among those compounds which have been referred to as tautomeric, using this term in a general sense so as to cover all cases of mobile configuration. This is the kind of instability among stable compounds which most nearly complies with the biological conditions. But such cases are at present limited both in number and in phase. In spite of the great complexity of many synthetical compounds the number of definite forms capable of being assumed in cases of tautomerism is generally limited to two, or, it may be said that the possibilities of assuming atomic configurations in response to chemical and physical stimuli are in these cases limited to two.

Now there is physical and, especially, optical evidence in support of the view that certain molecules in which the atoms are capable of assuming two or more different configurations may, under different external conditions, exist in varying proportions in two or more forms simultaneously. In such cases two or more atomic configurations may be said to be adapted to a particular environment.

molecular mobility of atomic configuration and not in the purely physical sense in which Spencer uses the term when discussing the chemical composition of organic and organized matter in Chapter I of the *Principles of Biology*. Growth in the initial stages of the development of living from lifeless organic matter would from this point of view be more analogous to inorganic growth, just in the same way that the primordial 'organized' carbon compounds were more closely related to dead carbon compounds. If it is claimed that the special and distinguishing character of living matter is its power of 'directing' without creating energy, may not the action of catalysts or 'contact' substances, which direct the course of chemical change without undergoing any change themselves be put forward as an analogue ?

We have here the chemical analogue of a dimorphic or polymorphic species. Now what the biologist requires in order to bridge the gap between living and dead carbon compounds may possibly be an internal mobility or lability of the order indicated—not a restricted tautomerism, but a comparatively unlimited responsivity to varying environments ; a highly enhanced faculty of tautomerization. The survival of carbon compounds may from this point of view be the result either of extreme stability, as in ordinary pyrogenic synthesis, or of extreme internal lability conferring adaptability to variable conditions, such adaptability enabling these particular atomic groupings to resist destructive agencies. If there is anything in this suggestion, then the development of life has been just as much a process of selection as the subsequent differentiation of living organic matter into specific forms. Out of numbers of primordial synthetical products containing carbon none have survived but the stablest 'mineral' compounds, such as carbon dioxide and (possibly) hydrocarbons on the one hand, and, on the other hand, the lineal descendants of those protoplasmic corpuscles to which the most highly susceptible tautomerizable compounds gave rise. Modern physiological research, and especially the work of Bayliss and Starling, favours the view that in the lowest forms of protoplasmic life the responsivity is even now of a purely chemical character.

I am fully aware that this discussion amounts to little more than a restatement of the old problem—not of the *origin*, but of the development of living from lifeless matter, a point which Spencer has of course dealt with in a general way.[1] All that is claimed is that the case has possibly been stated in more specific terms than hitherto, and certainly in a more distinctly Darwinian sense. At certain stages of scientific development it is always useful to raise questions even if the present state of knowledge does not admit of their being answered.

[1] See particularly the *Principles of Biology*, chap. i.

But out of this treatment of the subject there arises a further question which may be worthy of some consideration. It has already been suggested that in a globe cooling down from an igneous state and containing carbon as an element, the probabilities are that many compounds of this element would be formed. Now the elements essential for living matter are carbon, hydrogen, nitrogen, and oxygen, and, without raising the at present unanswerable question as to the precise order of combination and the nature of the primordial 'organic' compounds, it is quite certain that a molecule composed of these four elements, even in its simplest form, is already a highly complex compound from a purely chemical point of view, and, as such, admits of numerous possible configurations, or, in other words, would be capable of existing in several isomeric or tautomeric forms. If only one such quaternary compound were synthesized we should therefore have several possible starting-points for future development, and if several such compounds were synthesized there would be an abundant supply of raw material for the selective action of the environment. If the principle of multiple synthesis be conceded, then the earth or the ocean in azoic times may have been as colonized by organic compounds as it subsequently became by living organic matter during the early stages of the life period. The question that may be asked is therefore whether it is likely that out of a number or possibly large numbers of dissimilar or of isomeric or tautomeric compounds one only should have possessed the necessary mobility of configuration to give rise to living matter. Of course this may have been the case, but, on the other hand, it may not. Probability would appear to be against the monogenetic development of life—so also is analogy, for it is certain that similar combinations of metallic and non-metallic atoms must have taken place in past ages at many distinct centres as shown by the occurrence of the same mineral products in widely separated parts of the earth. At any rate the notion of the

possibility of there having been vital polygenesis seems worthy of being filed for future consideration. On this view the primordial protoplasmic units need not necessarily be conceived as having been all of one uniform chemical type—there would have been a sufficiently close chemical relationship to give rise to apparently similar protein compounds and yet sufficient dissimilarity of structure to produce divergence on further development. The likeness and unlikeness would be of the same order as that which obtains among the complex isomeric compounds of carbon now known to chemists. It has frequently been pointed out that even at the dawn of life, as shown by the geological record, a marked differentiation of type had taken place. This is generally explained, and no doubt correctly explained, by the obliteration of the earliest records of the life period by metamorphic changes of the primitive rocks and so forth.

But there may also be scope for the influence of primordial 'isomerism' in the sense suggested. Could we restore the very earliest records of life upon this globe we might expect to see on this view a much greater convergence towards a common type than is now shown among the fossils of the Cambrian rocks, and yet not absolute uniformity—a dissimilarity due not altogether to the struggle for life and survival of the fittest but in part to the heritage of the primordial dissimilarity of composition or of the 'isomerism' of the ancestral carbon compounds. Darwin's well-known metaphor of 'life, with its several powers, having been originally breathed by the Creator into a few forms or into one'[1] may thus have a real scientific basis.[2]

[1] *Origin of Species*, 6th ed., p. 429.

[2] It is only right to point out that the views advanced in this section are at variance with Spencer's statement concerning the inapplicability of the Selection Principle to inorganic phenomena. See 'Filiation of Ideas', p. 558. Chemical analogies have been made use of by Spencer, especially in the *Principles of Biology* (Chapter I and Appendix), but in a quite different sense to that now advocated. The nearest approach to the present treatment of the subject that I have been able to find is by Karl Pearson in the *Grammar of Science*, and especially in § 12,

Returning now to the earlier history of the modern doctrine of Evolution, it is admitted that the publication of the *Origin of Species* gave such an enormous stimulus to evolutionary thought that Spencer's writings received much greater attention than would otherwise have been accorded to them. The highly abstract reasoning and the more purely deductive treatment in the *First Principles* and its successors did not appeal to the majority of scientific workers with such force as Darwin's more concrete method of dealing with the problem of organic evolution. Spencer himself, with that candour which throughout marked his attitude toward his great contemporary, has admitted this influence in specific terms in relating the history of the revision of the first (1855) edition of his *Principles of Psychology* :—

'The tacit assumption, and towards the close of the work the avowed belief, that all organisms had arisen by evolution, and the consequent conception running throughout the whole work that the phenomena of mind were to be interpreted in conformity with that hypothesis necessarily (in 1855), roused not sympathy, but antipathy. It was only after the publication of Mr. Darwin's *Origin of Species*, some four years subsequently, and only after this work—drawing so much attention, causing so much controversy—began presently to affect deeply the beliefs of the scientific world, that the views contained in the *Principles of Psychology* came to be looked at more sympathetically.' [1]

In attempting to estimate the relative parts played by Darwin and Spencer in moulding evolutionary thought we must, as before urged, bear distinctly in mind that fundamental difference in method of attack—the expres-

p. 356, ed. 1900. To prevent possible misunderstanding it may also be advisable to emphasize that the hypothesis of multiple synthesis now suggested has no relationship to the hypothesis of the 'multiple origin' of species so ably discussed by Professor Poulton in his latest work, *Charles Darwin and the Origin of Species*, Appendix A, p. 247.

[1] Duncan's *Life and Letters*, p. 140. Darwin admits (*Origin*, 6th ed., p. 428) that the foundation on which Psychology had been based by Spencer was 'well laid'.

sion of that dissimilarity in mental constitution which has already been referred to. It would be extremely presumptuous on my part to attempt a comparative analysis of methods and results, but such comparison will assuredly have to be made by some competent philosophical critic in the future. The opinion may certainly be hazarded that the verdict of posterity will be that Spencer's mind was more of the synthetical and Darwin's of the analytical type. There is ample material in the life work of these great pioneers for measuring what may be termed the intellectual expansive force of Science and Philosophy respectively. The attitude of scientific workers toward Philosophy before the dawn of Evolution was often contemptuous—sometimes hostile, and very generally apathetic. It may be said that Spencer, more than any other writer since the time of Bacon, has succeeded in basing Philosophy upon a foundation of science. For him Philosophy was completely unified Science, a definition accepted broadly with certain qualifications and additions by that keenest of modern critics, the late Professor Henry Sidgwick :—

'No student of any special science ever acquiesces in having no idea of the relation of his part of knowledge to the rest. He may avoid Philosophy in the sense of avoiding the attempt to make his conception of the universe as clear, precise, and systematic as possible, but that only means that he will be content with a vague, obscure, and altogether inadequate conception.' [1]

'I have taken it to be the business of Philosophy—in Mr. Spencer's words—to "unify" or systematize as completely as possible our common thought, which it finds partially systematized in a number of different sciences and studies.' [2]

[1] *Philosophy, its Scope and Relations*, p. 11. The extent to which Sidgwick follows or departs from Spencer can only be adequately ascertained by reference to the whole chapter from which the above extract is taken.

[2] Ibid., p. 105. See also George Henry Lewes: 'As Science is the systematization of the various generalities reached through particulars, so Philosophy is the systematization of the generalities of generalities. In other words, Science furnishes the Knowledge and

Spencer's treatment of Evolution was philosophical in its generality—in being broader than the widest generalizations of any particular science. His generalizations were based upon a foundation of such breadth that they had to be expressed in the most general and therefore the most highly abstract terms. The function of Philosophy—if Philosophy is assigned any function in the development of human thought—is to work up available knowledge as rapidly as possible into abstract formulae or principles of sufficient generality to cover all possible applications to particular classes of cases. From this point of view Spencer's method was sound in principle, even if the very generality of his treatment led to the alienation of his generalizations in one or another of their applications from the more restricted but safer generalizations of the special sciences. This extreme breadth of treatment is no doubt one of the reasons why he failed to impress the scientific world to the same extent as Darwin. The philosophical method is a dangerous weapon in unskilled hands; scientific men knew it then and know it now. The broader the generalization and the more diverse the various classes of phenomena which it attempts to embrace, the greater the liability to error—the more unsafe does the method become. It is a method which may result in generalities too vague to have any immediate bearing upon scientific method, or which, in its haste to arrive at an abstract formula, may base conclusions upon imperfect knowledge and lead to generalizations altogether erroneous. The passage from philosophy to nonsense is a short one, as may be seen from the voluminous literature supplied by the paradoxers and faddists of all ages.

Philosophy the Doctrine.' 'Philosophy has no distinct province of knowledge: it embraces the whole world of thought; it stands in relation to the various sciences as Geography stands to Topography. All the sciences subserve its purpose, furnish its life-blood. It systematizes their results, co-ordinating their truths into a body of Doctrine.' —*Science and Speculation*, chap. i, § 4. From the Prolegomena to the 3rd ed. of the *History of Philosophy*.

But the writer of philosophy takes this risk. There was much justification for the attitude of caution on the part of scientific men towards a method which had not helped them much in the past, and which was by many, if not by most, considered to be superfluous for the future. The effectiveness of the method, however, depends altogether upon the person who uses it. On this point I shall have more to say in the concluding part of this lecture. Of Spencer's work it may be said that no more heroic, and I will add no more successful, attempt to wield single-handed such a mighty weapon as unified science has ever been made. If Science no longer looks askance at Philosophy, but recognizes therein a most powerful ally, it is mainly due in modern times to the impression produced by the author of the *Synthetic Philosophy*.

The history of the influence of his treatment of organic evolution upon the mind of his illustrious contemporary may now fittingly be set forth in juxtaposition to his reception of Natural Selection. This influence is certainly among the most instructive illustrations upon record of the effect of the abstract method upon one of the greatest contemporary wielders of the concrete scientific method.

The celebrated essay on 'The Development Hypothesis', published by Spencer in 1852, must have been read by Darwin about 1858, when, as already stated, the author sent a copy of his *Essay* containing this particular contribution to Darwin, who acknowledged it on Nov. 25 in these terms:—

'Your remarks on the general argument of the so-called development theory seem to me admirable. I am at present preparing an abstract of a larger work on the changes of species; but I treat the subject simply as a naturalist, and not from a general point of view, otherwise, in my opinion, your argument could not have been improved on, and might have been quoted by me with great advantage.' [1]

[1] *Life and Letters*, vol. ii, p. 141.

In 1866 he wrote to Hooker concerning the *Principles of Biology* :—

'I have now read the last number of Herbert Spencer. I do not know whether to think it better than the previous number, but it is wonderfully clever, and I daresay mostly true. I feel rather mean when I read him : I could bear and rather enjoy feeling that he was twice as ingenious and clever as myself, but when I feel that he is about a dozen times my superior, even in the master art of wriggling, I feel aggrieved. If he had trained himself to observe more, even if at the expense, by the law of balancement, of some loss of thinking power, he would have been a wonderful man.' [1]

In acknowledging the receipt of the complete volume in 1867, he wrote to Spencer :—

'In many parts of your *Principles of Biology* I was fairly astonished at the prodigality of your original views. Most of the chapters furnished suggestions for whole volumes of future researches.' [2]

Again, in 1870, writing to Ray Lankester with reference to the work on *Comparative Longevity* by the latter, Darwin said :—

'It has also pleased me to see how thoroughly you appreciate (and I do not think this is general with men of science) H. Spencer. I suspect that hereafter he will be looked at as by far the greatest living philosopher in England ; perhaps equal to any that have lived.' [3]

Of particular significance also is the following paragraph in a letter to Wallace, written in 1872, with reference to Bastian's work on 'archebiosis' :—

'I am not convinced, partly I think owing to the deductive cast of much of his reasoning ; and I know not why, but I never feel convinced by deduction, even in the case of H. Spencer's writings.' [4]

[1] Ibid., vol. iii, p. 55.

[2] *More Letters*, vol. ii, p. 442. Also the letter to Hooker, 1866, ibid., p. 235. In this letter he states, 'I have almost finished the last number of H. Spencer and am astonished at its prodigality of original thought. But the reflection constantly recurred to me that each suggestion, to be of real value to science, would require years of work.'

[3] *Life and Letters*, vol. iii, p. 120.

[4] Ibid., p. 168.

The contrast between the methods of the two founders so strikingly brought out by these extracts receives, so to speak, official sanction by Spencer's analysis of his own disposition :—

'But I must not forget another trait of nature—a relative liking for thought in contrast with a relative aversion to action. My physical constitution did not yield such overflow of energy as prompts some natures to spontaneous activity. In many directions action was entered upon rather reluctantly; while thinking was a pleasure. Obviously this predominant tendency to contemplation has been a factor in my career.' [1]

No further evidence than that furnished by the foregoing extracts is required to prove that the influence of Darwin and Spencer respectively has been determined entirely by the difference in the method of attack adopted by the contemporary founders of modern Evolution. It is also clear that the difference in the effects of the two modes of treatment upon the scientific world involves the consideration of the fundamental question of validity of method. It is no disparagement of Darwin to say that he was working at a lower level than Spencer, because his foundation was thereby made more secure; nor is it an exaltation of Spencer to say that he was working at a higher level than Darwin, because his foundation was thus rendered less secure. The question that posterity will have to decide is, I venture to think, not whether the scientific method is valid—because on that point there is no doubt—but how far the abstract or philosophical method is legitimate as a means for the advancement of science. We have, during the Victorian age, been provided with the unique example of two of the most powerful intellects of the time arriving at the same great generalization by different methods. Spencer arrived at Evolution as a principle from the consideration of a certain number of very diverse groups of phenomena, and based a system of philosophy upon his generalization;

[1] 'Filiation of Ideas,' p. 536.

Darwin arrived at organic Evolution by the consideration of an immense mass of biological evidence, and out of his generalization there has also arisen a philosophy of Evolution.

So far as concerns Evolution in the abstract the two systems have now become welded. Even if with advancing knowledge it could be shown that all Evolution is Darwinian—and this is far from being the case at present—there would still be no divergence in main principle between the two founders, because Spencer was thoroughly Darwinian in his recognition of Selection, and Darwin was equally Spencerian in recognizing the evolutionary principle where Selection had not been shown to be applicable.

In view of this coalescence of results it may be permissible therefore to examine somewhat more closely into this all-important question of validity of method. And in the first place let it be understood—for there is no point on which public judgement is more apt to err—that in Science soundness of method by no means implies infallibility of results. We declare unhesitatingly that the scientific method is sound, but we also recognize that the method can deal only with facts and observations learnt by a being of finite mind with sense organs of a limited range. And so with increase of knowledge resulting from improved methods of experiment and observation—in other words, from a perfecting of our methods of gleaning information from Nature, this same scientific method enables us to amplify, check, revise, correct or modify previous results. We grope our way towards truth by laborious and tortuous paths ; we stray into many blind alleys and are led astray by many false scents and occasionally we fall headlong into a pit from which a later generation has to dig us out. It may not be paradoxical to say of Science that her main strength lies in her being cognizant of her fallibility. As Professor Macallum, quoting a saying by Duclaux, well puts it in his recent address to the physiological section of the British Association : ‘The reason why Science advances is that

it is never sure of anything.' The scientific worker knows full well that his methods are not infallible, but he also knows that, however imperfect the methods and results, there is an infallibility underlying them—he knows that his labours are making for the infallible truths underlying Nature's methods. Moreover, his confidence in his methods is such that he is justified in his belief that there are none other open to intellectual beings of finite intelligence. He might say of them as does Touchstone of Audrey :—' A poor . . . thing, sir, but mine own ' ; nevertheless he may confidently challenge the history of the intellectual development of the human race to produce evidence of any mastery over Nature or any real knowledge of Nature's mode of working having been acquired by any other methods than those of observation, experiment, induction, and deduction.

I feel that an apology is due even for attempting the vindication of the scientific method before this audience, but in a country which is not yet pervaded by the spirit of Science there is no doubt that our cause suffers considerably from the imposition by an unscientific public of a false standard of finality. The lability—the adaptability, the unlimited receptiveness of Science for new truths by which her triumphant progress is secured is not sufficiently realized. It is the unscientific laity and not the high priests of Science who from time to time endeavour to invest her generalizations with the authority of ecclesiastical dogmas, and then, because with the progress of discovery correction or modification is found to be necessary, declare that Science as a cult is unworthy of confidence. The history of scientific progress is summed up in a few terse phrases : Method indisputably sound ; information imperfect, but constantly approximating towards greater perfection ; conclusions dependent upon information available.

Judged by these criteria the statement that Darwin's work is representative of the highest application of the scientific method is simply the assertion of a truism.

With respect to Spencer's method it may be claimed that it is philosophical inasmuch as he himself considered his whole system to be, and entitled it, a system of Philosophy. How then does Spencer's treatment differ from Darwin's, and why is it that one method should have commanded a higher degree of confidence than the other? This brings me back to the main question of the influence of the philosophical method upon scientific progress. It is with very great diffidence that I venture to handle this subject, for I have already disclaimed any pretension to have been a special student of Philosophy. But if the question be asked, what constitutes the philosophical method?—then the answer must depend very largely upon what view we take with respect to the scope of Philosophy. Here again I shelter myself under the authority of Professor Sidgwick, who states that a generation ago the predominant opinion amongst English thinkers was that the 'Science of Mind' or of 'Man' was 'Philosophy Proper'.[1] It is remarkable that a country which produced Bacon should have taken this narrow view of Philosophy—but so it was, and this no doubt explains why we, as students of Natural Science, failed to recognize any close relationship between Science and Philosophy. It was Spencer who changed the outlook for us. To his influence I have already attributed the changed attitude of Science toward Philosophy, and to his influence may also be ascribed the changed attitude of Philosophy toward Science.[2]

Now the first conclusion of importance to Science that may be drawn from Spencer's conception of Philosophy

[1] *Philosophy, its Scope and Relations*, p. 35.

[2] Far from restricting the scope of Philosophy to the 'Science of Mind' (thereby in former times meaning human mind), we are now beginning to recognize that mental science is as much the subject of legitimate scientific experimental and observational inquiry as any other branch of science: that the mode of working of the organ of mind must be understood before any true 'science of mind' can be created. In other words, 'Experimental Psychology' is taking its natural place among the sciences.

is that there is no difference in kind between his method and Darwin's, but only a difference in degree—that the philosophical method is the scientific method writ large. Within its own limits every branch of Science is striving to create a minor philosophical system out of the materials at its disposal. The generalizations of Science pass by imperceptible steps into philosophical generalizations, and no hard and fast line can be drawn between them. If the generalizations of one department of Science encroach upon another or other Departments of Science, there may be sufficient comprehensiveness to warrant the erection of a philosophical system, such, for example, as in the former use of the term Natural Philosophy to embrace unified Physical Science.[1] It is merely a question of comprehensiveness as to what shall be considered a law or principle of Science and what shall be raised to the dignity of a philosophical system.

If, therefore, it can be shown that underlying all the generalizations of Science there is a still more comprehensive principle, that principle must, from the scientific point of view, become a Natural Philosophy in the very highest conception of the term. This is just what Spencer devoted his life to proving, and we have accepted his view that Evolution—whether his precise formula is the best that can be conceived or not—is such an all-embracing principle. Not that it is thereby proved that there is no other principle at work in Nature, but that, so far as we now know, Evolution is descriptive of Nature's actual method of working, and that it is therefore amongst the broadest generalizations that unified scientific knowledge has hitherto given to Philosophy. More than this—the recognition that there is what may be termed a general mode of procedure in Nature has widened the horizon of every worker in the realm of Science. While recognizing that specialization of work is necessary in order to achieve

[1] It is of interest to note that the chief publication of the Royal Society, which embraces all 'natural knowledge', still bears the title 'Philosophical Transactions'.

results of value, the scientific investigator who has grasped the Spencerian conception in its complete significance receives the additional stimulus derived from the knowledge that his labours will result in a contribution to that universal Science which constitutes Philosophy.

The recognition that there is one universal Science is in fact tantamount to the admission that our divisions and subdivisions into special sciences are artificial and do not correspond with the reality of Nature; they are convenient but arbitrary divisions necessitated by imperfect knowledge and by the limitation of human faculty. It must, I think, be admitted that the consolidation of natural knowledge under the influence of the evolutionary idea marks a real advance in our conception of Nature as a consistent whole; it will not be denied that for that advance Science and Philosophy in the nineteenth century are mainly indebted to Herbert Spencer.

A system of Philosophy based upon Science might by virtue of its origin be expected to be capable of being used as a means for promoting further scientific progress. As in the narrower domain of each special science we are justified in using, and do in fact use, our generalizations deductively in order to test their soundness by applying them to particular cases, so the broader and more comprehensive philosophical principles should, if valid, be capable of being wielded deductively in every department of Science, since, in the Spencerian sense, a science, as now understood, is simply a subdivision of Philosophy created by human agency for purposes of expediency. The method which is valid in Science in detail cannot logically be denied to Science in its totality. The question how far Spencer's deductions are valid thus resolves itself into a question of the same order as that relating to the soundness of scientific conclusions in general. To exact a standard of infallibility from a philosophical system based upon Science is as unscientific as the imposition of finality upon the conclusions of Science. The validity of Spencer's conclusions derived from the application of the

general principle of Evolution to this, that, or the other set of phenomena cannot be challenged on the ground of unscientific method, but can only be judged by the same standard as that by which we judge other scientific conclusions—the evidence submitted, or rather the weight assignable, to the evidence.

The deductive method in physical science has never been challenged: the more highly developed the science, the more freely is the deductive method employed :—

> 'The successful process of scientific inquiry demands continually the alternate use of both the *inductive* and *deductive* method. The path by which we rise to knowledge must be made smooth and beaten in its lower steps, and often ascended and descended, before we can scale our way to any eminence, much less climb to the summit. The achievement is too great for a single effort ; stations must be established, and communications kept open with all below.' [1]

If, therefore, the Spencerian treatment of Evolution commanded less confidence among scientific men than the more concrete method of Darwin, some other explanation must be found than the violation by the author of the *Synthetic Philosophy* of the recognized principles of the scientific method. The reasons are not difficult to produce ; how far these reasons were or are valid must be left to posterity to decide.

In the first place the man of science, by virtue of his training, is alone capable of realizing the difficulties—often enormous—of getting accurate data for induction.

[1] *Preliminary Discourse on the Study of Natural Philosophy*, 1831, p. 175. See also George Henry Lewes, *Science and Speculation*, chap. ii, § 24 : 'The distinguishing characteristic of Science is its method of graduated Verification and not, as some think, the employment of Induction in lieu of Deduction. All science is deductive, and deductive in proportion to its separation from ordinary knowledge and its co-ordination into system. The true antithesis is not between Induction and Deduction, but between verified and unverified cases of Induction and Deduction.' It is obvious that as soon as we attempt to verify an Induction we are using it deductively, and are thereby investing it with philosophic rank as being worthy of sufficient credence to consider it necessary to confront it with reality.

In other words, it is only the active worker—the original investigator—who, by personal appeal to Nature through artificially imposed conditions, i.e. experiment, or through observation, i.e. ready-made phenomena, has come to understand fully what a *fact* really means in the scientific sense; to realize how laborious is the process of wooing truth and how ambiguous are the answers often given by Nature to his cross-examinations. I have elsewhere recorded a humorous rejoinder by Darwin [1] on one of the very few occasions when it was my never-forgotten privilege to have met him; as this reply bears so closely upon the present topic I will venture to repeat it. I had been dwelling upon this very point of the difficulty of getting Nature to give a definite answer to a simple question, when, with one of those mirthful flashes that occasionally lighted up his features, he retorted: 'She will tell you a direct lie if she can.'

Judged by the standard of the scientific expert it is obvious that Spencer could not have been expected to influence the scientific world to the same extent as Darwin, for his achievements as an original investigator shrink into insignificance when compared with those of his illustrious contemporary. As Professor Bourne has well put it in last year's Herbert Spencer Lecture, it would have been practically impossible for the author of a system of philosophy based upon unified science to have become an investigator in every department of science. If an expert in any sense he was a biologist, and his position as such has been fairly stated by Professor Bourne. But although he was not constantly in direct commune with Nature, as was Darwin, it cannot fairly be said that he was not an investigator at all.

There certainly has been a tendency of late years to do injustice to Spencer in this respect. I am afraid that we of the later generations are rather too apt to minimize the work of our predecessors, upon whose shoulders we

[1] Presidential address to the Entomological Society of London, *Transactions*, 1896.

stand, forgetful of when the work was done and judging it only in the light of modern methods and appliances. The fairer test is the estimate of those who were his contemporaries as Evolutionists. Huxley, it will be remembered, speaks of him as 'outside the ranks of biologists', but this refers to the period of the publication of the Darwin-Wallace theory in 1858–9, and Spencer's work on the circulation of the sap in plants and the first edition of the *Principles of Biology* were not published until 1866–7. Happily two of his contemporaries, Hooker and Wallace, are still with us, and from both these I have received letters (see Appendix to this Lecture) showing that by his contemporaries he was regarded as an original investigator.

The difference in the impression produced upon contemporary science by Darwin and Spencer respectively cannot, however, be ascribed solely to their relative positions as original investigators; another cause must be added. Up to the time of the enunciation of the theory of Natural Selection the biological sciences were more or less in an empirical or descriptive stage. With the exception of Lamarck's famous attempt there had never been a really systematic philosophy introduced into biology. In this respect the biological sciences had lagged far behind the physical sciences. As a result of this retarded development—due largely to the mysticism attached to life—broad generalizations were strange to the minds of biologists who were, as a body, quite unaccustomed to grasp such generalizations or to use them deductively. This same influence retarded the acceptance of the Darwinian theory—still more might it be expected therefore to have retarded the recognition of any conclusions resulting from the more purely deductive treatment of Evolution by Spencer. There are no doubt many now living who can remember cases of extraordinary mental density among experts, and particularly among pure systematists—not in questioning the soundness of the theory—because that might be a legitimate subject

for scientific discussion—but in their comprehension of what the theory really meant and in their failure to realize that a theory with so much *prima facie* probability might in accordance with all scientific precedent be used deductively to test its validity.[1]

It is clear that the Spencerian treatment was wanted as a co-factor with the Darwinian treatment. His work was in our hands just at the right time, and there is no doubt whatever that large numbers of science students were enormously stimulated thereby. The two prime methods of induction and deduction were for us personified by the two great founders of the doctrine of Evolution.

In pointing out that the more liberal use of the deductive method in the biological sciences was urgently needed at that period it must be understood that from the scientific point of view the scientific use of the method only comes under consideration. To accept a deduction as a scientific truth without verification is unscientific, and it must be confessed that both Darwinians and Spencerians have been too apt to accept 'what might be' or 'what ought to be' for 'what is'. But from the philosophical point of view a deduction takes another aspect. Granting that such or such a principle arrived at inductively is true, then such or such results should follow. That is the deduction for both Philosophy and Science. Now it is the business of Philosophy in the Spencerian sense, if it is in possession of the broadest of generalizations, to formulate these deductive conclusions—to tell us for guidance 'what might be' or 'what ought to be'. If that be disallowed, then there seems to be no scope for Philosophy as an instrument either of scientific progress or of human culture. If the deductive conclusions are accepted off-hand as demonstrated truths, so much the worse for Science; if they are

[1] See, for instance, Darwin's letter to D. T. Ansted in 1860, published in my address to the Entomological Society of London in 1897; *More Letters*, vol. ii, p. 175.

used legitimately as stimulants to scientific research, then they may lead to results of lasting value. It is thus a question of division of labour between two great classes of workers making for the same end.

Is the Philosopher from this point of view bound to verify his own deductions?—is it essential for him, in order to secure a hearing, to convert his plausible guesses, conjectures, suggestions, or hypotheses into positive contributions to Science? I venture to think that in principle there is no such necessity; in practice it might be expedient—if actually attempted there can be no doubt but that he would profit by the experience. But it is not the *necessary* function of the Philosopher to experiment or to observe: it is for him to work up the material supplied by Science and to elaborate therefrom doctrine for scientific verification. The question whether Spencer was or was not an original investigator thus sinks into minor significance. That he did his duty toward Science as a Philosopher is virtually admitted by Darwin in those memorable passages in his letters to Spencer and Hooker recording the impression produced upon him by the perusal of the *Principles of Biology*.

The doctrine that it is permissible to philosophize, and especially to philosophize in the Spencerian sense, without being an original investigator, requires further justification. To some it will appear a principle too dangerous for recognition; to some it may even have a savour of heresy. That it is a risky undertaking has already been admitted, but, as has also been pointed out, whether it succeeds or fails depends entirely upon the person who incurs the risk. It cannot be maintained that specialization as an investigator qualifies as a philosopher. I suppose that most of us could point to very sorry efforts at philosophizing on the part of expert researchers of the highest rank. Specialization as an investigator may actually lead to atrophy of the philosophical faculty, just in the same way that constant concentration upon abstract principles may disqualify for experimental and

observational work. The two types of mind are different, and both are wanted. In Darwin alone do we meet with the unique example of the combination of the two faculties in the same individual. But Darwin, be it remembered, philosophized only within the domain of organic Evolution, while Spencer's Philosophy embraced the whole domain of Evolution.

If justification for the use of the deductive method by those who have not themselves contributed the data be looked for among the sciences, a good case can be made out. That which is sanctioned within the narrower confines of the special sciences is no less justifiable for Science as a whole. In those sciences in which the observed facts are capable of quantitative expression, such as astronomy, physics, mechanics (in the abstract sense), &c., conclusions of the greatest general importance have been arrived at deductively by men who have never carried out an experiment or made an observation. It is, of course, admitted that in these sciences the data are capable of being dealt with by the most powerful and the most perfect of all deductive weapons—the mathematical.

Now what Spencer did, virtually amounted not only to a vindication of the right of all the sciences to stand on the same footing as regards their mode of treatment, but to the insistence on the necessity for the use of the deductive method as a means of advancement in the biological sciences in the same sense that it is a recognized method in the physical sciences. He may not state so explicitly in his writings, but there can, I think, be no doubt that this is a legitimate interpretation of his teaching. His attempt was confessedly a bold one in view of the fact that in his time the biological sciences were not amenable to quantitative treatment, and that their data had not been brought within the sphere of symbolical reasoning. It is in fact only in comparatively recent times that biological data have been dealt with quantitatively on a sufficient scale and with sufficient precision to enable them to be handled deductively. I refer, of course, to

the new science of Biometrics founded by Sir Francis Galton and headed by Professor Karl Pearson—a science in the development of which this University, through the late lamented Professor Weldon, has played a most conspicuous part.

But the right to use—the necessity for using the deductive method irrespective of the consideration whether the science is amenable to quantitative treatment or not, is pre-eminently the outcome of the Spencerian Philosophy in its relations toward Science. If deduction is only to be used when the generalization from which we start has all the certainty of a mathematically demonstrated truth, we are postponing, *sine die*, the development by one legitimate method, of all those sciences in which the data are so complex as to baffle quantitative treatment now, and possibly for all time. All that can be urged therefore against Spencer's treatment is that it was premature—that, to use a homely expression, he 'rushed' the biological sciences into the deductive stage before they were ripe for such treatment. But this only amounts to the admission that he was in advance of his time. And so he was, and so has been every philosopher in every age who has ever attempted to systematize human thought.

The judgement delivered upon Herbert Spencer as the result of that comparative study of his work with that of Darwin, which I have advocated as a fitting task for some critical philosopher of a future age, cannot, I imagine, be based upon the actual contributions to Science contained in the *Synthetical Philosophy*. We have all realized that this work, in certain parts and in common with the sciences upon which it is based, suffers from 'imperfect information'—that sooner or later it will have to be recast in the light of new knowledge. Many modern specialists have dwelt upon their reasons for dissenting from Spencer's conclusions in one direction or another, but few have indicated his positive services to Science as the vitalizer of the philosophical method as an instrument in scientific progress in those departments

which had failed to recognize its power. Among the later departures the most divergent is probably the Weismannian doctrine of the non-transmissibility by inheritance of what are known as 'acquired characters'—a doctrine which most of us believe to have a preponderating balance of evidence in its favour. That point was ably dealt with by Professor Bourne in last year's Herbert Spencer Lecture. To the last Spencer opposed, and we may fairly say very ably opposed, this attempt to eliminate the final trace of Lamarckism from organic evolution. It cannot be said that we are as yet in a position to write *finis* to this chapter of biological controversy.

When the time is ripe for a revised *Synthetical Philosophy* it may safely be predicted that no single individual will be able to undertake that task, but, as has well been pointed out, that a syndicate of experts will be required. And when that revision is called for and when we know more about the mechanism of development in inorganic and organic nature we shall still have a *Synthetical Philosophy* on Spencerian lines, with Evolution as the central idea. Regarded as a philosopher, the founder of that system will no more suffer in reputation by the revision of his scientific data than will the lustre of Charles Darwin's name be diminished by the revision of his scientific data in the light of scientific progress. We now smile upon Bacon's science as puerile, but he did his best with the scientific faculties within him and with the materials available in his time. His contemporary, William Gilbert of Colchester, appears to have had more of the scientific faculty, but Bacon's fame as a philosopher is not thereby diminished, nor is his rank as a philosopher determined by his contributions to science. The Spencerian philosophy as a philosophy based upon science may—nay must—undergo development, but if Evolution is true in principle—as we believe it is—that philosophy may be expected to survive throughout the ages by that most effective of all evolutionary processes, 'Descent with Modification.'

APPENDIX

Extract from a Letter from Alfred Russel Wallace, dated June 23, 1910.

'As to Herbert Spencer, his style in his systematic work is such as to repel many readers. His terminology was often obscure and his reasoning often tremendously elaborate. But when attacking any special problem of biology or physics he was wonderfully luminous. I remember being greatly impressed by his Linnean paper, 'On Circulation and the Formation of Wood in Plants' (*Trans. Linn. Soc.*, Vol. XXV. Read March 1, 1886. Appendix C, *Principles of Biology*, Vol. II). It shows what a lot of experiments he made, how constantly he appealed to the experimental method and how admirably he reasoned on it. This paper, written in 1865, before Darwin had begun his work on the movements of plants, shows, I think, that if Spencer had been less of a thinker and more of a specializer he could have rivalled Darwin as an investigator. I have always been interested in sap motion—a problem *not yet settled*, and yet Spencer, more than forty years ago, seems to have thrown more light on it than any one else. On the whole, Spencer, I think, still ranks as the greatest all-round thinker and most illuminating reasoner of the Nineteenth Century.'

Extract from a Letter from Sir Joseph D. Hooker, dated October 14, 1910.

'I have great pleasure in assuring you of the high esteem in which I held my dear late friend Herbert Spencer's scientific position. Of his ability to support his views by arguments derived from the vegetable kingdom there can be no question, but this is a very small matter in contrast to the skill with which he seized upon facts and suggestions and the patient labour with which he sought to test them by experiments, often devised and carried out by himself unaided. It was my privilege to be kept fully cognizant of these operations of his mind, his eyes and his hands, to supply him now and then with materials from Kew, and always with encouragement—but beyond these he owed me nothing.'

Oxford: Printed at the Clarendon Press by Horace Hart, M.A.

BIOLOGICAL FACT
AND THE
STRUCTURE OF SOCIETY

THE HERBERT SPENCER LECTURE

DELIVERED AT THE EXAMINATION SCHOOLS
ON WEDNESDAY, FEBRUARY 28, 1912

BY

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BIOLOGICAL FACT AND THE STRUCTURE OF SOCIETY

THERE are signs that the civilized world is at length awakening to the fact that the knowledge needed for the right direction of social progress must be gained by biological observation and experiment. Such a turn in public opinion would, we may be sure, have been viewed by Herbert Spencer with exceptional interest and approval. The truth, so obvious to the naturalist, that man is an animal, subject to the same physical laws of development as other animals, is a doctrine he constantly expounded, and perhaps his teaching did more than that of any other philosopher towards helping men to see themselves as they really are, stripped of the sanctity with which superstition and ignorance have through all ages invested the human species.

Spencer not only contributed that great service, but I suppose that no one ever looked forward with serener confidence or a fuller optimism to the consequences which follow upon a recognition of these natural facts, to the possibility of a further evolution of our species, and to the certainty that by his own action the destiny of man may be controlled. It is natural therefore that in a lecture founded to commemorate his work we should examine the possibilities of biological discovery as applied to the constitution and future of human society.

Many causes have combined to give prominence at this moment to the biological aspects of Sociology. There exists a general perception on the part of the more intelligent that the present condition of the social

structure in civilized states is one of extreme instability. The apprehension that changes of exceptional magnitude are impending is widely spread. In addition to these indefinite sensations of uneasiness, the minds of observant persons are becoming keenly alive to the fact that the unexampled changes in the conditions of human life, made possible by the applications of science, are likely to result in an alteration of the composition of the population. Owing to the control which civilized communities have acquired over the forces of nature the average human life has been materially lengthened, and we need no evidence beyond that of ordinary experience to show that especially have the lives of those who are defective in mind or body been prolonged by application of these new powers on their behalf.

A general acquaintance with the idea of Evolution, in outline at least, has become universal. We are all habituated to the notion that the form of a society, like that of an individual, is a consequence of an evolutionary process. To that process experimental interference on an enormous scale is being applied, and it is inevitable that the community at large should be asking, not without anxiety, how far the outcome of these interferences with what have usually been regarded as natural forces will bring good or evil to the societies which attempt them. Within the last few years, moreover, mankind has suddenly begun to realize what heredity means. The deliberate interferences hitherto contemplated by economists have related to the distribution of wealth and opportunities of many kinds, the regulation of supply and demand, the creation or abolition of divers political institutions, and other measures of similar character. Though the effects of these devices are commonly described as profound, such measures are indirect, and

to the mind of the naturalist most of them are essentially superficial. Every legislative encouragement given to one class and every repression of another has an effect on the future of the race. Exerted over long periods of time, these interferences must indeed influence the composition of a population; but with knowledge of the full meaning of the physiological process of heredity we perceive that man has it in his power to operate upon his species in a much more drastic way. In Spencer's time and long before, this fact was obvious to all who reflected on the matter. He himself in many passages alludes to these possibilities. In 1873, for example, he wrote:[1]

'If any one denies that children bear likenesses to their progenitors in character and capacity—if he holds that men whose parents and grandparents were habitual criminals, have tendencies as good as those of men whose parents and grandparents were industrious and upright, he may consistently hold that it matters not from what families in a society the successive generations descend. He may think it just as well if the most active, and capable, and prudent, and conscientious people die without issue; while many children are left by the reckless and dishonest. But whoever does not espouse so insane a proposition must admit that social arrangements which retard the multiplication of the mentally-best, and facilitate the multiplication of the mentally-worst, must be extremely injurious.'

In the period when these words were written practically nothing was known of heredity. Naturalists knew that in general offspring resemble their parents more or less, and that by selection for an indefinite number of generations types could be fixed so as to breed approximately true. That there was a vast province of exact

[1] *The Study of Sociology*, ed. 1908, p. 343.

and readily ascertainable knowledge, fraught with immeasurable practical consequence to mankind, hidden behind the word *heredity* had occurred to scarcely a single mind.

Many were perfectly aware of the importance of heredity. All upholders of evolutionary doctrines, both those who preceded Darwin and those who followed him, were familiar with the fact that change of type came about through the inheritance of modification. In many admirable and striking works the late Francis Galton had endeavoured to direct attention to the practical significance of heredity. He had shown also that the descent of characters could be partially expressed in a system, which, though erroneous in fundamental conception, still gives an approximately correct representation of several of the phenomena.

But the discovery of Mendelian analysis, though as yet imperfectly developed, opens up a new world of physiology. Expressed in the briefest possible way the essence of the Mendelian principle is not difficult to grasp. It may be conveyed in the statement that organisms may be regarded as composed to a great extent of separate factors, by virtue of which they possess their various characters or attributes. These factors are detachable, and may be recombined in various ways. It thus becomes possible to institute a factorial analysis of an individual.

How far such analysis can be carried we do not yet know, but we have the certainty that it extends far, and ample indications that we should probably be right in supposing that it covers most of the features, whether of mind or body, which distinguish the various members of a mixed population like that of which we form a part. From such a representation we pass to the obvious con-

clusion that an individual parent is unable to pass on to offspring a factor which he or she does not possess.

Just as various features or characteristics may be due to the *presence* of the corresponding factor, so we have to recognize that other attributes appear only in the *absence* of certain factors. Moreover, since those individuals only which are possessed of the factors can pass them on to their offspring, so the offspring of those that are destitute of these elements do not acquire them in subsequent generations but continue to perpetuate the type which exists by reason of the deficiency. You will readily understand that in practice the analysis and detection of these factors is a difficult matter. The difficulty arises especially from the very important fact that some of the ingredient-factors have the property of *inhibiting* or masking the effects of other factors, and that many features of bodily organization are due to the *combination* and interaction of two or more ingredients, which alone might be present without producing any perceptible sign of their presence. Thus one flower may be white, because it is lacking in the element which produces colour; but another may be white though it has everything needed to give it colour, because it has in addition an element which suppresses the pigmentation. Again, colour in some plants is due to one factor, but in others it is developed only when two independent complementary factors are present, and either of these may be present alone in a flower which is perfectly white.

Such rules have been demonstrated in operation for an immense diversity of characteristics in both animals and plants in great variety. It should be explicitly stated, however, that in the case of the ordinary attributes of normal men we have as yet unimpeachable evidence

of the manifestation of this system of descent for one set of characters only, namely the colour of the eyes.

There is nevertheless no reasonable doubt that the extension to the normal attributes of man is one which we are well entitled to make. For with the doubtful exception of certain features of quantity, size, and number, no characters of animals and plants which have been made subject to adequate experimental tests have hitherto proved incapable of being represented as governed by such a system. Moreover, if the evidence as to normal characteristics of man is defective—which in view of the extreme difficulty of applying accurate research to normal humanity is scarcely surprising—there is in respect of numerous human abnormalities abundant evidence that a factorial system of descent is followed.

To appreciate the full significance of these things one must have practical experience of breeding. I wish it were in my power to bring to the minds of such an audience as this some part of the emotion which the contemplation of this display of order can excite. Imagine a greenhouse stage full of a miscellaneous collection of varieties of some plant, such as the Chinese Primula, with all their varied shapes of leaves and flowers. Their colours also seem at first sight to range through an endless series of tints of magenta, crimson, pink, and blue. By appropriate treatment we have it in our power to determine that in three generations at the most the offspring of these plants, the generation in fact which will then replace them and represent them, shall be entirely of one type only, or of two types, or three types in any required proportion. By choosing which parents shall leave offspring we can decide how the species shall be represented on our stages with a certainty almost as great as if the selection were made from plants

already grown. And similarly for fowls and many other forms of life. Write *Man* for Primula or fowl, and the stage of the world for that of the greenhouse, and I believe that with a few generations of experimental breeding we should acquire the power similarly to determine how the varieties of men should be represented in the generations that succeed.

At a cattle-show I look at the splendid animals in their pens, ranged breed by breed, and I look at the farmers and the sight-seers passing by them in procession. They too are of manifold types, men from all parts of the country, often showing the characteristics of their race plain and easy to recognize—big men, little men, men who fill out or 'mature' early, as they say in the meat-market—spare men, that the farmers would call 'bad doers', tame men, vicious men, sharp and dull, dark and fair—shepherds, stock-men, grooms, butchers, and salesmen. Could they too be arranged breed by breed in pens? A few most certainly could. (We might make a pen of shepherds and we should not often put in a groom by mistake.) Why could not all be sorted into breeds? The answer is obvious: because they are the offspring of matings made almost at random—and for no more recondite reason.

Many are disposed to imagine that the conditions of life play a great part in producing the diversity of such a mixed assemblage, but the more we learn of biological fact the less do we find much evidential ground for that opinion. The conditions of life provide opportunity for the development of characters, but they cannot increase the original endowment. If the right opportunity be withheld the characteristic does not appear. If the stout man had been starved from his birth, obviously his disposition to stoutness might have remained unknown;

but the spare man, like the razor-back pigs of the Southern States, will not fatten though he take five meals a day. And so for qualities that may be regarded as more subtle. A muscat grape will produce its aromatic flavour if it have sun and a suitable soil,—the pretentious Gros Colmar, with its fruits half as large again, is not worth eating, though it be fostered with all the gardener's skill. These qualities are, as we say, *genetic*, given to the creature at its birth, brought into it on fertilization by one, or by the other, or by both of the cells which united to produce it. That the conclusions to which experimental studies of animals and plants have led us apply also on the whole to the descent of human faculty can be doubted by no one who has studied the evidence.

If any one is not already convinced he should refer to the accumulated proofs which Galton so successfully collected, especially in *Hereditary Genius*. Let him study any biographical records of human achievement or conduct—such as a dictionary of painters or of musicians—and observe the perpetual recurrence of the same names in groups of two, three, or more; or the geographical distribution of illegitimacy, showing as it does the maintenance of 'local custom' and morals under divers conditions of occupation, soil, and climate; or the pedigrees collected in medical literature showing the descent of disease; or if he look no further than the distribution of qualities among the families known to himself he will be forced to the admission that, though the circumstances among which a man is born or thrust have some influence in the development and direction of his powers, yet the total contribution which circumstance makes to achievement is of that subordinate kind which is adequately described by the word 'opportunity'.

Men do not gather grapes of thorns or figs of thistles;

and what is so clear for the budding branches of the plant would be no less obviously true of the branching generations of our species, were it not for the fact that we each of us come from the union of *two* cells derived from two parents. The fact that we arise by this sexual process throws, however, but a thin veil of obscurity over the laws of descent, and it is interesting to notice that if only human or any other pedigree-tables had been arranged to be read *downwards instead of upwards*, the essential fact of Mendelian segregation must have been long ago discovered in regard to many characteristics. Genealogists have been accustomed to make a table of descent as a fan, with its apex in the individual whose origin they wish to display and its base widening as far as possible into the ancestry, the parental stock of each ancestor being represented by a pair. But to show how a character really descends we require the table constructed with its apex in one original individual who possessed the character, and from that apex to exhibit the devolution of that character among the diverging branches of his posterity. As the usual purpose of the genealogist has been to contribute either to political history or to family pride, rather than to natural knowledge, his mind has consequently been set on a demonstration rather of the origin and antiquity of his hero's qualities than of their distribution or absence among the collaterals.

I do not propose on this occasion to adduce facts in support of the general proposition that human genetic physiology follows in the main systems similar to those discovered in animals, but rather, assuming that this truth is admitted, to examine some phenomena of social physiology as they appear in the light of this knowledge.

May I clear myself at once of a possible misunderstanding? You will think, perhaps, that I am about to advocate interference by the State, or by public opinion, with the ordinary practices and habits of our society. There may be some who think that the English would be happier if their marriages were arranged at Westminster instead of, as hitherto, in Heaven. I am not of that opinion, nor can I suppose that the constructive proposals even of the less-advanced Eugenists would be seriously supported by any one who realized how slender is our present knowledge of the details of the genetic processes in their application to man. Before science can claim to have any positive guidance to offer, numbers of untouched problems must be solved. We need first some outline of an analysis of human characters, to know which are due to the presence of positive factors and which are due to their absence; how and in respect of what qualities the still mysterious phenomenon of sex causes departures from the simpler rules of descent, and many other data which will occur readily enough to those who are familiar with these inquiries. It is almost certain, for instance, that some qualities are transmitted differently according as they are possessed by the mother or by the father, and it is by no means improbable that various forms of conspicuous talent are among their number. It should be borne in mind that we do not yet know even which females among mankind correspond to which males. In man sexual differentiation is generally strongly marked. The case is almost like that of poultry. If a breeder ignorant of the breeds of poultry were asked to sort a miscellaneous assemblage of cocks and hens into pairs according to breed, he would often be quite at a loss to know what a given male type looked like when represented in a hen, and conversely. He would thus

make many mistakes even when dealing with pure breeds; and in man, as individuals pure-bred in any respect are very rare, the operation would be far more difficult. For these and other reasons I am entirely opposed to the views of those who would subsidize the families of parents passed as unexceptionable. Galton, I know, contemplated some such possibility; but if we picture to ourselves the kind of persons who would infallibly be chosen as examples of 'civic worth'—the term lately used to denote their virtues—the prospect is not very attractive. We need not for the present fear any scarcity of that class, and I think we may be content to postpone schemes for their multiplication.

As regards practical interference there is nevertheless one perfectly clear line of action which we may be agreed to take—the segregation of the hopelessly unfit. I need not argue this point. When it is realized that two parents, both of gravely defective or feeble mind, in the usual acceptance of that term, *do not have any normal children at all*, save perhaps in some very rare cases, and that the offspring of even one such parent mated to a normal generally contain a proportion of defectives,[1] no one can doubt that the right and most humane policy is to restrain them from breeding, and I suppose the principle of the Act now before Parliament for the institution of such a policy will have general approval. Under our present system the State exerts

[1] From such pedigrees as I have seen I should nevertheless hesitate to describe feeble-mindedness as a simple Mendelian recessive. It is possibly due to an absence of some factor or factors; but there is strong evidence that the usual result of a mating between normal and feeble-minded parents is a proportion of feeble-minded children, and it is difficult to suppose that most ostensibly normal persons are heterozygous in this respect. See especially H. H. Goddard, *Amer. Breeder's Magazine*, 1910, i. 172.

all the powers which science has developed for the preservation of such persons from their birth, most of whom would otherwise perish early. Brought to maturity their destiny is not difficult to imagine. However ignorant we may be as to the several ingredients which are required to compose a stable society, or of the proportions in which they are severally desirable, we are safe in preventing these creatures from reproducing themselves. Some of the more advanced of the American States are already going further, and even such a representative of older ideas as the State of New Jersey is, I am informed, introducing the practice of sterilizing criminals of special classes. That appears to me the very utmost length to which it is safe to extend legislative interference of this kind, until social physiology has been much more fully explored.

Beyond that if there is authority to go, it is not drawn from genetic science. If a person who is born with cataract, or develops cataract very early in childhood, has children, it is almost certain that half those children will inherit the cataract, with varying degrees of blindness. The prospect is more or less the same for several other defects. Nevertheless, though from these causes many remain grievous burdens to their families, or to the public funds, and though they could probably be eliminated after a few generations without difficulty by legislative interference, that would be a very dangerous course. They are not necessarily useless persons, nor are their own lives necessarily miserable. There are many healthy and active types which are a far greater nuisance to their neighbours and reproduce themselves with equal exactitude. Possibly, on a ballot, few of us would be encouraged to perpetuate our likenesses! We all have grave defects, not least those

who contribute much to the happiness of the world. The monogamous pigeons sitting on the barn roof perhaps are scandalized at the polygamy of the fowls in the yard. Such decadence, they hold, is disgusting and should be stopped. The fowls no doubt would reply that they may be polygamous and even polyandrous, but as for decadence, they at least don't limit their families to two. Such degeneracy is race-suicide and they think it should be punished. And so the debate might continue.

Seriously, let us remember that a polymorphic and mongrel population like ours descends from many tributary streams. We are made of fragments of divers races, all in their degree contributing their special aptitudes, their special deficiencies, their particular virtues and vices, and their multifarious notions of right and wrong. Many of us have, for instance, the monogamous instinct as strong as pigeons, and many of both sexes have it no more than fowls. Why should some be ambitious to make all think or act alike? It is much better that we should be of many sorts, saints, nondescripts, and sinners. Posterity is likely to discover that to eliminate sinners there is only one way—that which St. Paul pointed to us when he wrote that 'where no law is, there is no transgression'. Science knows nothing of sin save by its evil consequence. In all reverence she inverts the ancient saying and proclaims that the sting of Sin is Death. It is not the tyrannical and capricious interference of a half-informed majority which can safely mould or purify a population, but rather that simplification of instinct for which we ever hope, which fuller knowledge alone can make possible. As science strengthens our hold on nature, more and more will man be able to annul the evil consequence of sin. Little by little

the law will lapse into oblivion, and sins which it created will be sins no more.

The great and noble work which genetic science can do for humanity at the present time is to bring men to take more true, more simple, and, if so inexact a word can be used intelligibly, more natural views of themselves and of each other. With fuller knowledge of the physiology of races, and of the intimate relation between the physiological composition of the individual and his vital possibilities, all the problems of social organization show new aspects, and the vision is cleared of the fancies with which subjective ingenuity has overlaid the facts. How hard it is to realize the polymorphism of man! Think of the varieties which the word denotes, merely in its application to one small society such as ours, and of the natural, genetic distinctions which differentiate us into types and strains—acrobats, actors, artists, clergy, farmers, labourers, lawyers, mechanics, musicians, poets, sailors, men of science, servants, soldiers, and tradesmen. Think of the diversity of their experience of life. How few of these could have changed parts with each other. Many of these types are, even in present conditions, almost differentiated into distinct strains. In no wild species, not even among the ants, so often quoted, do we find any polymorphism approaching to this. I never cease to marvel that the more divergent castes of civilized humanity are capable of interbreeding and of producing fertile offspring from their crosses. Nothing but this paradoxical fact prevents us from regarding many classes even of Englishmen as distinct species in the full sense of the term. In a strident passage the acute Cobbett long ago expanded this conclusion:

'I am quite satisfied, that there are as many *sorts* of men as there are of dogs. . . . It cannot be *education* alone that makes the amazing difference we see. Besides, we see men of the very same rank and riches and education differing as widely as the pointer does from the pug. The name, *man*, is common to all the sorts, and hence arises very great mischief. What confusion must there be in rural affairs, if there were no names whereby to distinguish hounds, greyhounds, pointers, spaniels, terriers, and sheep-dogs from each other! And what pretty work, if, without regard to the *sorts* of dogs, men were to attempt to *employ them*! Yet this is done in the case of *men*! A man is always a *man*; and without the least regard as to the sort, they are promiscuously placed in all kinds of situations. . . . What would be said of the 'Squire who should take a fox-hound out to find partridges for him to shoot at? Yet would this be *more* absurd than to set a man to law-making who was manifestly formed for the express purpose of sweeping the streets or digging out sewers?'[1]

The problem which confronts the political philosopher is to find a system by which these differentiated elements may combine together to form a co-ordinated community, while each element remains substantially contented with its lot. To discuss this mighty problem in its full scope I have neither qualification nor desire. All that I can venture to contribute are some reflections which must come often to the minds of naturalists who contemplate the facts. They may be familiar enough to those who engage in the study of human affairs, but I have noticed that among those natural divisions between the sorts of men to which I just referred there are few more marked than that which usually separates students of natural knowledge from those who care nothing for it; and with rare exception you will find that publicists of the various denominations are almost always in this latter

[1] W. Cobbett, *Rural Rides*, ed. 1853, p. 291.

group.[1] Legislators, nevertheless, whether they know it or not, are engaged in a practical experiment with living things of a peculiarly intricate kind.

Many features of social phenomena evidently wear to the legislator aspects entirely different from those which they present to us. Lately, for example, the nation has been debating the virtual abolition of the hereditary Chamber—obviously a problem to the solution of which biological data are essential. I did not see in the public utterance of any statesman an allusion even to this aspect of the matter. Yet such data are neither very difficult to collect nor to interpret.

Let us think of the criminal law and consider how a system can satisfy the legislator which to the naturalist is stupid and infamously cruel. Just now I spoke of the polymorphism of mankind. No one trained in biology is ignorant of that phenomenon. True we realize it now as we never did before the study of heredity had developed, and I doubt not that before many years are past genetic research will have successfully represented the varying compositions of many at least of the more aberrant types of men by irrefutable analysis. If we have not yet these exact expressions, none of us doubt they can be found. Yet 'in the sight of the law', as the phrase goes, all men are equal! Are they equal

[1] Mr. Canning did not learn till late in life that tadpoles turn into frogs, and thought that a schoolboy who gave him that information was fooling him. Mr. Gladstone believed that twenty-eight was the normal total for the human teeth. Portentous ignorance of this kind is common among historians and legislators. In itself perhaps a trifle, it is a symptom of detachment from the actual world so complete as to disqualify a man from safely exercising high functions of statesmanship, demanding, as they must, a discernment which can only come from wide knowledge of natural fact.

in the sight of any one less blind than Justice? We do not find them equal in the out-patient room, in the school, at the recruiting dépôt—why in the court of law? If a lawyer cares to know how criminal procedure looks to biologists, let him read the sentence pronounced in *Erewhon*[1] by the judge on the prisoner convicted 'of the great crime of labouring under pulmonary consumption'. After expressing the pain he felt at having to pass a severe sentence on one who was yet young, and had otherwise excellent prospects, he continued:

'You were convicted of aggravated bronchitis last year: and I find that though you are now only twenty-three years old, you have been imprisoned on no less than fourteen occasions for illnesses of a more or less hateful character; in fact, it is not too much to say that you have spent the greater part of your life in jail. It is all very well of you to say that you came of unhealthy parents, and had a severe accident in your childhood which permanently undermined your constitution; excuses such as these are the ordinary refuge of the criminal; but they cannot for one moment be listened to by the ear of justice. I am not here to enter upon curious metaphysical questions as to the origin of this or that—questions to which there would be no end were their introduction once tolerated, and which would result in throwing the only guilt on the tissues of the primordial cell, or on the elementary gases. . . . I do not hesitate therefore to sentence you to imprisonment, with hard labour, for the rest of your miserable existence.'

A humane man—a lawyer too—after witnessing such a scene, not in *Erewhon* but in London, said once to me that he did think the judge might have noticed that the prisoner's head was a different shape from anybody else's in the court. The sickening cruelty of the courts is, I am happy to think, abating somewhat, but there will be no radical improvement until the functions of the

[1] *Erewhon*, by Samuel Butler, 1872, p. 96.

administrator of criminal justice are recognized as in the main medical. The criminal may be and often is hopeless; but if his case be one for treatment, let us treat it with the only remedies capable of doing any good. Give him occupation, distraction, change of thoughts, if it be possible. These, and not solitary confinement, are the treatment we should prescribe for ourselves when we fear temptation.

Take the two converse aspects of the question of population. Infant mortality is conventionally regarded by both statesmen and philanthropists as deplorable, without further inquiry.[1] Do they consider from what prospect most of these infants are delivered? Would it be better that they should be preserved to fill the workhouse infirmaries?

Other public men profess indignation against the practice, almost universal among the more intelligent and more provident classes in civilized countries, of limiting their families to two or three children. Have these patriots estimated what the pressure upon the

[1] Such an infatuation does this idea become even with statistical experts, that I find so careful a writer as Dr. Newsholme saying without qualification 'that each member of the population, when the balance between expense of subsistence and wages earned through life is worked out, represents enormous wealth'. This passage is introduced with the words 'It has been already pointed out'; but even in the place where the subject is more fully treated and Farr's calculations are given, the only reservation overtly made is for the aged. Dr. Newsholme of course means that on an average of the population there is a balance of profit, and on an average of wage-earners a high profit, not that 'each member of the population . . . represents enormous wealth'. Yet that section of the population whose value is negative should be constantly and explicitly mentioned; for there is nothing to show that a reduction in total population is incompatible with an equal or even greater profit on the whole. (See Newsholme, A., *Elements of Vital Statistics*, 1889, pp. 69 and 14.)

resources of the country would be if we mostly had six to ten children, as our parents had? The naturalist knows that a great part of the population of this country ought not to exist at all under present conditions of distribution. To add greatly to the number even of the able and thrifty will not diminish the proportion of the unfit or lighten the strain. What would be thought of a breeder who tried to keep all his stock? He wants no more than he can do well; otherwise his stock and he too will soon be ruined. The distinction which Malthus drew between 'a redundant population and one actually great' is sound, biologically as well as in economics. It is not the *maximum* number but the *optimum* number, having regard to the means of distribution, that it should be the endeavour of social organization to secure. To spread a layer of human protoplasm of the greatest possible thickness over the earth—the implied ambition of many publicists—in the light of natural knowledge is seen to be reckless folly. We need not more of the fit, but fewer of the unfit. A high death-rate is often associated with a high birth-rate, but happily a low birth-rate and a low death-rate are quite compatible with each other.

In the gloom which shrouds the future of civilized communities there is one fact which gives encouragement and hope, the decline in the birth-rate, associated as it now is with a decline in the death-rate also.

To most writers on these questions continual increase of the population of a country is regarded as the normal condition of things. This proposition is explicitly stated, for example by Rümelin,[1] in one of the leading text-

[1] '. . . so erscheint es nicht nur als empirische Tatsache sondern als die Ordnung der Natur, dass die Geburten in jeder menschlichen Gesellschaft einen Ueberschuss über die Todesfälle ergeben,

books. The naturalist knows, however, that such a phenomenon can be but ephemeral. He is accustomed to take longer views of the life of a species. In nature the numbers of a species can only increase when it is taking up fresh means of subsistence, in consequence of variation or otherwise. Parasites increase when they invade a new host. The rabbits increased when they invaded Australia, as did the sparrows in America. The population of this country increased very slowly till the latter half of the eighteenth century, when it began to rise sharply, but it was in the first third of the nineteenth century that the rate of increase became alarming, culminating in the misery of the forties.[1]

No one can doubt that the new means of subsistence which made this rise in population possible was the energy latent in the coal-fields. Nor have we to look far for the variation which enabled man to begin thus to devour the capital of the earth; and I suppose the coincidence of the first quick rise in population with the activities of that remarkable mutation, James Watt, needs

somit die *stetige Zunahme einer Bevölkerung* als die Normale, der Stillstand oder Rückgang stets als etwas Naturwidriges, als eine krankhafte, durch ausserordentliche Umstände begründete Störung zu gelten hat.' Rümelin, in Schönberg's *Handb. Polit. Oekon.*, 1890, i. 772.

[1] Sir A. Alison, *The Principles of Population*, 1840, i. 520: 'It is in the midst of this prodigious manufacturing population that the human race advances with alarming rapidity, and shoals of human beings are ushered into the world without any adequate provision existing for their comfortable maintenance. Such is the improvidence, the recklessness, and the profligacy which characterize the great bulk of the urban population in all the great cities of the empire, that the rate of increase bears no proportion to the permanent demand for labour: but mankind go on multiplying, as in the Irish hovels, with hardly any other limit than that arising from the physical inability in the one sex to procreate, and in the other to bear children.'

no special emphasis of interpretation. Sir William Ramsay estimates that the coal of this country will be exhausted in 175 years, and in his opinion it is in the highest degree improbable that any comparable source of energy will become available.[1] He limited his remarks to this country; but though there is no reliable means of estimating the coal in the earth as a whole, it is probable that within some period which is short as biology counts time, our species will be once more limited to the energy-income of the earth. We are in fact passing through a phase which is quite exceptional in the history of a species—exceptionally favourable if you will—and it is in a decline in the birth-rate that the most promising omen exists for the happiness of future generations.

Professor Marshall, discussing not the consequences of the exhaustion of coal, but another phase of the population question, remarks: 'It remains true that unless the checks on the growth of population in force at the end of the nineteenth century are on the whole increased (they are certain to change their form in places that are as yet imperfectly civilized) it will be impossible for the habits of comfort prevailing in Western Europe to spread themselves over the whole world and maintain themselves for many hundred years.' In a note to this passage he estimates that if the present rate of increase of human population continue till the year 2400 'the population will then be 1,000 for every mile of fairly fertile land: and so far as we can foresee now, the diet of such a population must needs be in the main vegetarian'.[2]

And now regarding the central problem of social

[1] *Presidential Address to British Association*, Portsmouth, 1911. This estimate followed that of the Coal Commission in excluding coal below 4,000 feet, which, if included, would prolong the period for perhaps a century.

[2] Alfred Marshall, *Principles of Economics*, third ed., 1895, p. 259.

structure, the conditions of stability in the relations of the human classes to each other and to the State, has biological science any counsel of value to give? Is there any observation that naturalists have made, knowledge acquired, or principles perceived in their study of the manifold forms of life, which in this period of grave anxiety they dare to offer as a contribution to political philosophy? Let us examine the physiological aspects of that problem. Upon the data there is now an agreement almost universal. Society consists of differentiated elements, unlike in tastes, faculties, sex, health, and ability of every kind. Some are strong, most are weak. If this complexity of civilization—the indispensable condition of evolutionary progress—is to continue, such differentiation, or some state approaching it, must be preserved. How then, in an age when knowledge is cheap and all know how the rest live, is any general content to be secured? Let us turn to the familiar comparison in which the community is likened to an organism with differentiated parts. The comparison is as old as Menenius Agrippa, or at least as Plutarch. It was one, too, which Herbert Spencer especially delighted to develop. Note next that to the biologist this presentation of the phenomenon is not a mere analogy but often a description of fact. The comparative anatomist cannot always draw a clear distinction between a compound organism with differentiated parts and a social organism with differentiated members.

I lay stress on this aspect of the social problem because I have seen several times of late the claim put forward that the teaching of biological science sanctions a system of freest competition for the means of subsistence between individuals, under which the fittest will survive and the less fit tend to extinction. That may

conceivably be a true inference applicable to forms which, like thrushes, live independent lives, but so soon as social organization begins, the competition is between societies and not between individuals. Just as the body needs its humbler organs, so a community needs its lower grades, and just as the body decays if even the humblest organs starve, so it is necessary for society adequately to ensure the maintenance of all its constituent members so long as they are contributing to its support. The simple hydroids, such as *Tubularia*, live alone, and no doubt compete freely against each other; but hydroids which remain united as compound forms have to let the food circulate among those degraded components which never even develop mouths, and all their lives function as tentacles. A body all muscle would be as helpless as a nation of Sandows; nor would a nation of Newtons live much longer than a brain removed from the skull.

From these considerations we may draw a conclusion that some elements of the doctrines vaguely described as socialism are consistent with, and indeed are essential to, stability. Society would do well to restrain competition between its parts so far as to ensure proper food and leisure for the lower grades of producers. How that restraint is to be effected is a question for the practical economist. Some such measures of restraint we have already enacted: on the whole with good results. Spencer, as every one knows, protested with vehemence against this legislation, but I have never been able to comprehend the biological grounds on which he based his protest. For if society is in reality an organism, society must apply restraints on the undue growth of its parts analogous to that co-ordinating mechanism which controls the growth of organs in the body.

Apart also from actual restraint by civil authority, there is happily hope of some effective restraint by change in public feeling.

Formerly, cruelty to domesticated animals was defended on the principle that 'a man may do what he likes with his own'. Civilized humanity no longer recognizes that defence; and slowly, even in our dealings with the weaker members of our own species, that change in public feeling has begun to act in restraint of oppression.

Motive for individual exertion must nevertheless be preserved. It could be dispensed with only in a community in which the component members were in *complete* co-ordination, as the organs of the healthy body are. The only instinct in our race which is sufficiently universal to supply this motive is the desire to accumulate property, generally as a provision for offspring. Other instincts, such as emulation, the altruistic emotions, or the mere love of activity, may all be strongly developed in some, but they are permanent in very few individuals. They are apt to weaken after adolescence, and to disappear as middle age supervenes. But for the institution of property the fibre of the whole community, as at present physiologically constituted, would slacken, and decay must immediately begin. Yet, admitting the principle that if life held no prizes no one would compete, might we not prohibit prizes of such magnitude as to jeopardize the stability of the community? To fix an upper limit on accumulation would not greatly discourage effort, for people will play hard, though the stakes be limited.

Socialism is a state that Nature knows well and has sometimes approved. Yet consider how this approval has been won. Hive bees, for example, are socialists:

the individual worker amasses no property for herself. They defend their hive. Every individual bee that stings you dies in a few hours. But the success of this socialism is founded in the instinctive, almost reflex, devotion of the bees.

Among us we have individuals who develop such feelings for a few years in early youth, and lose them later. A few possess these instincts all their lives. They sacrifice themselves, and but too often others also in their course. Such casual devotion is no base on which to form a social system. All permanent and stable change of institutions is founded in the physiological variation of instinct. In mankind we know a mysterious variation which we call change in fashion or in public opinion. It is to such a variation that constructive socialism must look for its foundation. This is but a slender hope; for that 'public opinion' must take the form of an instinctive, mystic devotion to society, not merely a passion to enjoy the fruits of other men's labour. Of socialistic public opinion in that fuller sense we see few signs.

Observe, too, how even the bees behave under sore temptation. Those who have witnessed the phenomenon of 'robbing' are not likely to forget the experience. If in August or September, when the honey-flow is failing, the bee-keeper drops a comb near his apiary, he knows what to expect. The bees find this honey undefended, easy to seize. They become instantly demoralized. They fight for it at random, stinging and tearing each other to pieces. They charge promiscuously into their neighbours' hives and indescribable pandemonium begins. After such a scene the ground is littered with dead bees in hundreds, and in the bottom of a hive I have seen a layer of bodies an inch or more thick.

Such is the instability of instinct even in the great prototype of socialism, and can we hope that the sight of undefended property would not similarly, in time of scarcity, upset the stability of a socialist State?

But there is still another side to the problem. If nature gives some clear guidance as to the distribution of the means of life, her teaching is even clearer as to the distribution of political power. Socialistic she may sometimes be, but democratic she is not. Turn once more to the physiological facts. 'All men are equal', say certain philosophers. 'That is not true', replies the naturalist. 'Proceed, then, as if it were', urges the statesman, and upon that course we have started. Founded in natural falsehood, the principle of equal rights is at length bearing fruits inevitable, though long deferred. The gift of equal power did not at first disturb the stability of society. Even the able seldom receive a new idea after they are grown up; for the foolish mass that process is then impossible.[1] A generation passes

[1] Herbert Spencer, in many of his strictures on the failure of legislation to achieve its avowed object, makes far too little allowance for the long latent period which often elapses before results appear. Commenting on the fact that laws rarely produce as much direct effect as was expected, and always produce indirect effects (which is all perfectly true), he proceeds to the following illustration, which at the present date reads somewhat naïvely: 'It is so even with fundamental changes: witness the two we have seen in the constitution of our House of Commons. Both advocates and opponents of the first Reform Bill anticipated that the middle classes would select as representatives many of their own body. But both were wrong. The class-quality of the House of Commons remained very much what it was before. While, however, the immediate and special result looked for did not appear, there were vaster remote and general results, foreseen by no one. So, too, with the recent change. We had eloquently-uttered warnings that delegates from the working-classes would swamp the House of Commons; and nearly every one expected that, at any rate, a sprink-

and their children, who learnt of it when young, become aware of the new power, with the consequences we are about to witness.

Of abstract rights, biology knows little: of equal rights, nothing. Philosophers have conceived men born with rights as they are with livers or with spleens. Perhaps they are; but since all those birthrights which can be expressed in terms of health or powers of mind or body are unequal, we find it difficult to suppose that there is some other kind of rights which we possess equally. Some would reply that *equal opportunity* is the right of all. But what use is equal opportunity to those who cannot use the opportunity equally? Either we must waste our strength in creating opportunities for those who cannot profit by them, or by aiming at the lower grades of mankind we deny to the rest the only opportunities which will enable them to develop.

All these familiar ideas will acquire new meaning in

ling of working-class members would be chosen. Again all were wrong.' *The Study of Sociology*, ed. 1908, p. 270.

So again he speaks with great contempt of the legislative efforts to suppress diseases among cattle, which (partly no doubt by the development of greater physiological knowledge) have now been very effective in most cases, and completely successful in many. In 1873 he wrote (*The Study of Sociology*, p. 164): 'Since 1848 there have been seven Acts of Parliament bearing the general titles of Contagious Diseases (Animals) Acts. Measures to "stamp out", as the phrase goes, this or that disease have been called for as imperative. Measures have been passed, and then, expectation not having been fulfilled, amended measures have been passed, and then re-amended measures; so that of late no session has gone by without a bill to cure evils which previous bills tried to cure, but did not. Notwithstanding the keen interest felt by the ruling classes in the success of these measures, they have succeeded so ill, that the "foot-and-mouth disease" has not been "stamped out", has not even been kept in check, but during the past year has spread alarmingly in various parts of the kingdom.'

the light of the new knowledge of the definite composition of individuals; and it would be well, perhaps, if those who are now contemplating a great extension of equal political power to still lower grades of our population would consider how such a proposal reads when translated into physiological terms.

The political reformer claims to raise the standard of a population by thus providing opportunity in ameliorating the conditions of life, and it is worth noting the sense in which his claim is physiologically justified. The gardener by pricking out his seedlings gives them a chance of developing. Left crowded in the seed-pan, none, or very few, will become decent plants. The few successful, if there are any, may owe their success to their special qualities, but more often than not it is determined by mere accident of position near the tally, or against the edge of the pan, where they get most water or light. The botanist knows too that wild plants growing in the competition of a turf or amongst brushwood are usually half-starved. Set out, clear of their kind, or of weeds, many of them can grow to twice the size. So with the crowded masses of humanity. They may, so to speak, be 'potted on'. Given hygienic conditions and better opportunities, they may develop into decent specimens, but they will not turn into better kinds. In the new countries the consequences of this process of planting out can be seen on a very large scale. The emigrants prosper. They are well fed. Except in a few large cities slums do not exist. All can develop; and if we do not expect what the gardener calls 'important novelties' the result is admirable.

It is upon mutational novelties, definite favourable variations, that all progress in civilization and in the control of natural forces must depend. How will *they*

fare in a socialistic community? What stimulus is left to tempt them to exert their powers? In the born discoverer the instinct to find out natural truth is a strong passion, and those who have that feeling will gratify it, just as the artist or the poet works when rejected by the market; but those who invent applications of discoveries are generally thinking of patent-rights, and if none are to be had, they may take life more easily. Is it not certain that all the forces of the community will be invoked against men of extra power? They will be treated as a disturbing nuisance. The progress of modification of a race composed of independent individuals can proceed by variation of individuals, but in a community organized on the principle of equality—if it can be imagined—an individual variation of any magnitude will be either without result or must produce immediate disorganization and disruption.

The ideals therefore of socialism and of democracy are incompatible with each other, and the incompatibility will appear when the period of destruction is over. It is strange that the two words are so commonly associated. 'Social democracy' denotes not one ideal but two. In order that the socialist community should succeed it must have but one mind, as the bees apparently have, not the uncoordinated resultant of all individual minds, which is the ideal of democracy. Until these two coincide, not occasionally only but in some permanent fashion, destruction may proceed but construction cannot begin.

The essential difference between the ideals of democracy and those which biological observation teaches us to be sound, is this: democracy regards class distinction as evil; we perceive it to be essential. It is the heterogeneity of modern man which has given him

his control of the forces of nature. The maintenance of that heterogeneity, that differentiation of members, is a condition of progress. The aim of social reform must be not to abolish class, but to provide that each individual shall so far as possible get into the right class and stay there, and usually his children after him. Men rise from below and fall from above, and the fact is sometimes appealed to as evidence that such vicissitudes are a normal and wholesome phenomenon. The naturalist sees that the convection currents to which such displacements are due must indicate special kinds of disturbance. These disturbances are mainly due to interbreeding between the social grades, and between sections of the population formerly isolated. Such rapid social diffusion must mean either that much original variation is happening, or that extraordinary changes are affecting the conditions of life. There is no doubt that in the case of our own age *both* phenomena can be recognized, but the human variations in mental power are the primary factor, and they have created the disturbance in the conditions of life. Just as the numbers of the population tend always to reach an equilibrium in which births balance deaths, so do the differentiated elements of the population tend always to find their particular level, near which they would stop till the mass is again disturbed.

The fact that families or individuals rose into prominence or dropped into obscurity when the great industrial development of this country began, does not prove that the strains from which they came ought previously and in differing circumstances to have been in different relative positions. In various circumstances various qualities are required for success. It would be useful to illustrate this by actual examples discussed from the biological standpoint, but it will be sufficient to say that

as we have come to recognize that evolutionary change proceeds not by fluctuations in the characters of the mass, but by the predominance of sporadic and special strains possessing definite characteristics, so in a society may previously existing types find their opportunity in the supervention of new social conditions.

When King David said, 'I have been young, and now am old: and yet saw I never the righteous forsaken, nor his seed begging their bread', thus asserting the permanence and heritability of success, he is thought by some to show himself singularly inobservant. But I doubt whether in the Middle Ages or in any other epoch when conditions were comparatively uniform over long periods of time, he would have been regarded as saying anything contrary to general experience.

However that may be, he is declaring what *ought* to be true in an ideal State. We have abolished the Middle Age conception of the State as composed of classes permanently graded, with the ladder of lords rising from the *minuti homines* below to the king on his throne, and yet to such stratification, after each successive disturbance, society tends to return.

But those *minuti homines*, how are they to be contented, for is it not the duty and the desire of all to content them? The first and greatest step towards such contentment is taken when the grades find their right places. At such a time as the present much of the intensity of discontent is due to the fact that some are at the bottom who should be higher, while some are high who should be lower. For time is of the essence of the proces s; and two generations have scarcely passed since the great changes began. Then, strange as it may seem, content is not so very rare after all. There is a discontent which is caused not because

something is withheld from us, but because we know our own inferiority; for that there is no cure. Decent food and lodging, however, go far to satisfy *minuti homines* in general. Very early most of us accept the truth of Schumann's aphorism, that if every one were determined to play first fiddle no orchestra could be got together.

As a boy in Cambridge I learnt that if a man got a first class he might be happy; if he got a second class he would be unhappy; if he got a third class, nothing but misery and a colonial life awaited him. When we grow older we unlearn these simple propositions, and we find that happiness is in many cases compatible with weekly wages and even with a pass degree. Some will have more than others. As in the body the heart is arranged so that the best blood goes to the head, so must and ought it to be with society.

Whatever is doubtful, this much I think is certain, that we are fast nearing one of those great secular changes through which history occasionally passes. The present social order is too unstable to last much longer, and he must be callous who greatly desires that it should. What will emerge from the approaching histolysis no one can predict. Let us hope, something better: and to this end may those upon whom devolves the duty of rearing that new organism, which is to grow from the dissolved tissues of society, be guided in their treatment, like physicians of the modern age, not by nostrum merely, but by the facts of natural physiology.

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ON ARISTOTLE AS A BIOLOGIST

WITH A

PROOEMION ON HERBERT SPENCER

BEING THE HERBERT SPENCER LECTURE
DELIVERED BEFORE THE UNIVERSITY OF
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BY

D'ARCY WENTWORTH THOMPSON

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ON ARISTOTLE AS A BIOLOGIST:

WITH A PROOEMION ON HERBERT SPENCER

Herbert Spencer was born when last century was young, and this century was in its cradle when he passed away. *Ipse Epicurus obit*, cried the poet of a philosophy which of all the systems of antiquity was most kindred to Spencer's own. A like thought passed through many men's hearts when Herbert Spencer died—men of all nations and languages, for while Spencer lived his voice reached far and wide, even to the ends of the earth. He was a philosopher not speaking to the philosophers, nor teaching in the schools; but he had a gift and a message, so in touch with the temper of his time, that it made him a speaker, *ex cathedra*, to the world. No philosopher of modern times, not Kant himself, has exercised in his lifetime so wide a dominion. Only here and there, among men of a very different stamp, in men like Byron or Rousseau or Tolstoi, do we see that strange power of captivating the imagination of an age, of speaking with a voice that goes out into all lands. The foundation under whose auspices we gather here, the gift of an Indian scholar, reminds us of Spencer's influence in the East: in still more distant Japan his counsel was sought when the nation issued from its seclusion to join in the labours and anxieties of the modern world; he stirred the restless blood of Russians and of Poles; in America his books were read far more sedulously than at home; and all this great influence was won without literary art

or any charm of magic words, without the fire of Tolstoi, the poetry of Heine or of Byron, the beauty of Rousseau's prose. But Spencer had something in common with all those men, as his popularity was commensurate with their own. And that bond of likeness lay in the fact that to men weary of old trammels and of old burdens he seemed to point, he tried to offer,[1] a way of emancipation, a path of deliverance from creeds outworn. By the world which he addressed he was welcomed and acclaimed, in the spirit in which Heine wished to be remembered, as a gallant soldier, *ein tapfrer Krieger*, in the fight for freedom.

Let us recall, with all brevity, some few circumstances of Spencer's life, that our minds may keep his memory green.

Of that narrow, ascetic, and fiercely independent home of his boyhood we have all read or heard—with its atmosphere of struggle, of criticism, of scientific and political discussion, unrelieved by humour, by letters, or by art. We remember how he went forth as a lad to labour, at an age when men have not yet come up to the University; and how, as an engineer's assistant, he helped to plan bridges and direct gangs of navvies on the great new road to Birmingham and Crewe, and shared in all the fever and haste of that great period of construction. These were the years that he spoke of afterwards as 'the futile part of his life'; but it is as plain as an open book that they were years in which his mind was moulded and his mechanical outlook on phenomena developed and confirmed. Again, we remember his years of journalism, during which, after the appearance of his first book, he soon emerged from a lonely life, and with the friendship

[1] Compare the opening passage of *Social Studies* (1864). '"Give us a guide," cry men to the philosopher. "We would escape from these miseries in which we are entangled,"' &c.

of George Eliot and Lewes, Huxley, Tyndall, and many more, found his place in the world of London. Henceforth, his life was so quiet, simple and retired, that we might say of him, as Heine said of Kant, ‘ Er hatte weder Leben noch Geschichte.’

In 1855, in the *Principles of Psychology*, Spencer affirmed his belief in the ‘ development hypothesis ’,[1] as accounting for the origin of species; and as accounting also for the successive association of ideas, and so, by their becoming ‘ innate ’ and transmissible from generation to generation, for the gradual development of mind: which latter investigation, I need hardly say, has since been continued, by a long line of evolutionary psychologists, in their several and divergent ways. It is curious to learn from his Autobiography that about this time, in his talks with Huxley, it was the latter who still preserved a guarded attitude, and Spencer who urged upon him, but with still inadequate and unconvincing arguments, the hypothesis of organic evolution.

Five years later, a year after the publication of the *Origin of Species*, Spencer brought out the prospectus of his *Synthetic Philosophy*, that heroic effort to combine, in a Philosophy of Evolution, the whole range of physical, mental, and social science. To discover and trace that one identical phenomenon of Evolution, in the progress of civilization, in the development of mind, in the course of nature, in the history of the Universe, was his single and life-long aim.

He found such tools as he worked with in the current tendencies of political and economic thought, and in the recent discoveries or generalizations of science. Of these latter, on the physical side, the greatest was the principle

[1] As already, in 1852, he had done in his essay on the *Development Hypothesis*.

of the Conservation of Energy, the final result of the doctrine of the correlation of the physical forces, in establishing which Rumford had led the way; while on the biological side he drew inspiration from the fact, indicated by Aristotle, developed by Wolff and Milne-Edwards, made into an aphorism by Von Baer, that as the organism grows it grows continually from the simple to the complex, from the homogeneous to a greater and greater heterogeneity.[1]

But many years before Von Baer a greater than he had enunciated the same truth, and had set it forth in even plainer and better words. It was Goethe, in his *Zur Morphologie*,[2] who laid it down as a law that 'the more imperfect a being is, the more do its individual parts resemble each other, and the more do these parts resemble the whole. The more perfect the being is, the more dissimilar are its parts. In the former case the parts are more or less a repetition of the whole; in the latter case they are totally unlike the whole. The more the parts resemble each other, the less subordination is there of one to the other; and subordination of parts is the mark of high grade of organization.'[3] Now these words are found in the *Life of Goethe*, by Lewes, Herbert Spencer's closest friend. We can scarce avoid the inference that it may have been the poet's insight and the poet's words, quite as much as Von Baer's, that crystallized in his famous formula of evolution. And the inference is confirmed by the fact that, though it was to Von Baer that Spencer was afterwards in the habit of ascribing the law, yet, on the first

[1] The 'law of differentiation', or of 'organic progress', was first propounded by Spencer in his essay on *Progress, its Law and Cause* (1857), where he argued that it was also the law of all progress whatsoever.

[2] 1807 (written in 1795). Republished in Goethe's *Werke*, xxxvi, p. 7.

[3] Lewes, *Life of Goethe* (1855), 3rd ed. 1875, p. 358.

occasion when he mentions it, he speaks of it as having been established ' by the investigations of Wolff, Goethe, and Von Baer '.[1]

As in former days Descartes, and as Democritus and Epicurus in days of old, so did Spencer find in matter and in motion, or rather in matter and in force, the fabric of a world. He draws a broad picture, confessedly of a mechanical kind, of alternate cosmic rhythms of the Universe, in which as motion is dissipated, so matter cleaves from the dispersed and homogeneous into more coherent and more segregated shapes ; until in the turn of the great wheel, a new redistribution of matter and motion takes place, and evolution is inevitably followed by dissolution at its heels ; so the whole present order perishes, *exitio terras cum dabit una dies.* Nevertheless, so vast is the cosmic rhythm, that again the wheel turns, and the dust and ashes of a Universe are co-ordinated and integrated anew, to make ' another and another frame of things, For ever ! '

All the while Spencer recognizes that Space, Time, Motion, and Matter itself are remote from Absolute Reality, and have their source in our own Empiricism. The ' Persistence of Force ' is the only truth which transcends experience ; and what we ultimately mean by the persistence of force is a cause which transcends our conception and our knowledge.

In his *Biology* Spencer takes for his keynote his conception of life, as having for its chief characteristic a continuous adjustment of the organism to its environment, of its internal to its external relations. So structure follows upon function and functional need, and hereditary transmission hands on to the next generation the advances

[1] Von Baer himself claimed no priority. ' Dieses Gesetz ist wohl nie verkannt worden,' *Zur Entwicklungsgesch.* (1), p. 153.

that the past generation has made: life produces organization, and not organization life. Again, in certain chapters which are by no means the least interesting of the book, he shows,[1] after the fashion of the engineer, and from the experience of the bridge-builder,[2] how the principles of stress and strain are concerned in the fabric, and in the physiology, of the organism; how physical and mechanical relations alter in the organism with increasing bulk;[3] and how incident forces of gravity, growth, and pressure control or determine the shape of leaf and bone and single cell. Under the guidance of a wholesome restraint, a whole school of morphologists, Roux's school of *Entwickelungsmechanik*, are now investigating these self-same problems, and so bringing to the help of morphology some of those physical concepts which began to be the stock-in-trade of the physiologists when Majendie wrote his *Leçons sur les phénomènes physiques de la Vie* (1830).

In the *Ethics*, Spencer undertakes to establish 'rules of right conduct' on a scientific basis, and he does not minimize the difficulty of getting rid of 'supernatural ethics', nor of forming a science of 'what ought to be'. Nevertheless, he does his best to connect absolute Ethics with his universal formula of cosmic evolution and equilibration. Ethics must be based on science, and not on metaphysics. There is, he holds, not only an Ethic for all reasonable beings, but a principle of Ethic for all living things; life

[1] As in an earlier essay on *The Law of Organic Symmetry*, 1859.

[2] Even in his *Sociology*, where he discusses the place of the *pontifices* in an archaic priesthood, he seems to dally with peculiar affection over these old *bridge-builders*.

[3] A curious corollary, or case in point, is found in the fact that definite limits are set to the size of a terrestrial animal, and still more to that of a flying bird, while the aquatic animal, comparatively immune from gravity, increases in locomotive speed, as a ship does, the bigger it becomes (*Princ. of Biology* (2nd ed.), i. 156).

and not reason is the essential thing. All conservation implies evolution, and individuality is developed by the inevitable changes of a changing world.[1] So Spencer labours, but perhaps in vain, to make the best of the *bellum omnium contra omnes*, to find in the biological process of adjustment a continual tendency to happiness, and in sociological evolution a tendency to ultimate harmony; in the which a somewhat complacent altruism shall satisfy the egoist, and pleasure will consist in actions which are salutary to the individual and the race. All very much as Mr. Bridges puts it:

> For Nature did not idly spend
> Pleasure; she ruled it should attend
> On every act that doth amend
> Our life's condition;
> 'Tis therefore not well-being's end
> But its fruition.

So through all the circle of the sciences, Spencer tried to satisfy that craving inherent in mankind for a constructive system, which shall, in a single unity, frame all the phenomena of the world: for such a unification as in Aristotle's hands had endured unshaken for nigh two thousand years. To bring the world of fact and the world of Intelligence into the unity of a system is the task which all philosophers essay, in the light of the knowledge and the spirit of their time; but as knowledge grows, and men's ways and circumstances change, so does Philosophy itself, like all else in the world, undergo its own inevitable and endless evolution—giving place, if not to the better, to the new.[2]

[1] 'C'est là l'idée capitale qu'il ajoute aux doctrines de Zénon, de Spinoza et de Volney:' Guyau, *La Morale anglaise contemporaine*, 1885, p. 268.

[2] The last words are quoted from Alden, *A Study of Death* (1895), 1903, p. 176; cf. *North Amer. Review*, January 1913.

But let me not omit to say a word of Spencer's attitude to 'the insoluble mystery', of his *confessio ignorantis*, of his share in that Agnosticism for which Huxley found a name. 'At the utmost extent of his tether,' to borrow words from Locke, 'he sat down in quiet ignorance of those things which he found to be beyond the reach of his comprehension.'

By a bold abstraction Spencer puts asunder things that our thought insists shall be conjoined. And, through relation, association, and causation, he carried to their bitter end those theories of empiricism, and of the relativity of knowledge, that were no new thing in philosophy, but had percolated down to him through Mansel and through Hamilton, from Locke and Hume and Kant, through all those who had discussed the possibility of knowledge in itself; carried them to their bitter end, and stripped them bare of the garments of the old philosophy, of intuition, or of faith, wherewithal they were wont to be clothed. And in so doing it may seem to many of us that he stopped short but a little way along that steep and narrow road, that *parvus trames*, which is the Pathway from Appearance to Reality.

Ipse Epicurus obît, decurso lumine vitae—'when the lamp of life ran low'. And so too Spencer died—as it were but yesterday—full of years and of honour. And to the multitude of friends, disciples, mourners, gathered at his grave, a wise and eloquent man spoke a few noble words. He spoke of Spencer's deep affections and lasting friendships, of the houses that he entered as an habitual guest and honoured friend; of the magnitude of his task, of his unwearied struggle, and of his joy when his work was done; of his 'coherent, luminous, conception of the evolution of the world'; of his exaltation of man's individual freedom, of the ethical

purpose that underlay his quest of truth. And, lastly, Lord Courtney spoke of Spencer's last brave effort, in the *Riddle of the Universe*, to face and scrutinize the implacable facts of life: of how in the end he had confessed himself overawed by the vastness of the unknowable, appalled by the great vision of Everlasting Law, and silent in the contemplation of the Infinite and the Eternal.

And now that I have tried to pay, in not ungrateful words, our annual tribute to Spencer's memory, as to one who has been a great influence in our world, whose words have become part of our familiar speech, and whose thought has interpenetrated and commingled with our own, let me proceed for what time remains towards another, but I hope a cognate, theme.

In passing from Spencer to Aristotle, we turn from the one philosopher of our own times who has made biology an intrinsic part of his sociology and his psychology, to the great biologist of antiquity, who is *maestro di color che sanno*, in this science as in so many other departments of knowledge. And by the analogy of contrast, we can scarce think of Herbert Spencer's biology without recurring to that of Aristotle, so reverting from a great teacher of mechanical causation to him who taught us our first clear lessons of the phenomena of Life. But, save only by repeating what I have said, that Spencer came to the study of biology in the spirit and with the equipment of the engineer, and by declaring that Aristotle seems to me to have been first and foremost a biologist, by inclination and by training, I will not attempt to pursue the comparison. Let us simply glance at some parts of Aristotle's *Natural History*, and attempt to show, in a partial and elementary way, the influence of that study upon his mind.

The naturalist is born a naturalist, and we may be sure that Aristotle was a lover and a student of nature from a boy; but it would help us to trace the relation of his biological studies to his philosophical work if we could ascertain when his chief biological work was done. It has often been held that Aristotle devoted himself to biology as an old man's recreation, after his retirement to Euboea. This theory is not adequate, and I do not think it is true. Another legend, that Alexander sent his pupil specimens from his campaigns, Cuvier accepted and Humboldt denied; there is no evidence for it, direct or indirect, in Aristotle's writings, and this tradition also I believe to be worthless. But there is evidence, of a geographical kind, that helps us to answer our preliminary question.

Among the isles of Greece there is a certain island, *insula nobilis et amoena*, which Aristotle knew well. It lies on the Asian side, between the Troad and the Mysian coast, and far into its bosom, by the little town of Pyrrha, runs a broad and sheltered lagoon. It is the island of Lesbos. Here Aristotle came and spent two years of his life, in middle age, bringing his princess-bride from the petty court of a little neighbouring state where he had already spent three years. It was just before he went to Macedon to educate Alexander; it was ten years later that he went back to Athens to begin teaching in the Lyceum. Now in the *Natural History* references to places in Greece proper are very few indeed; there is much more frequent mention of places on the northern and eastern coasts of the Aegean, from Aristotle's own homeland down to the Carian coast; and to places in and round that island of Lesbos, or Mitylene, a whole cluster of Aristotle's statements and descriptions refer. Here, for instance, Aristotle mentions a peculiarity of the deer on

a neighbouring islet, of the weasels by the wayside near another island town. He speaks of the big purple Murex shells at Cape Lectum, and of the different sorts of sponges found on the landward and the seaward side of Cape Malia. But it is to the lagoon at Pyrrha that Aristotle oftenest alludes. Here were starfish in such abundance as to be a pest to the fishermen; here the scallops had been exterminated by a period of drought, and by the continual working of the fishermen's dredge; here the sea-urchins come into season in the winter time, an unusual circumstance. Here among the cuttlefishes was found no octopus, either of the common or of the musky kind; here was no parrot-wrasse, nor any kind of spiny fish, nor sea-crawfish, nor the spotted nor the spiny dog-fish; and, again, from this lagoon, all the fishes, save only a little gudgeon, migrated seaward to breed. And though with no special application to the island, but only to the Asiatic coast in general, I may add that the chameleon, which is the subject of one of Aristotle's most perfect and minute investigations, is here comparatively common, but is not known to occur in Greece at all.

I take it then as probable, or even proven, that an important part of Aristotle's work in natural history was done upon the Asiatic coast, and in and near to Mitylene.[1] He will be a lucky naturalist who shall go some day and spend a quiet summer by that calm lagoon, find there all the natural wealth *ὅσσον Λέσβος . . . ἐντὸς ἐέργει*, and have around his feet the creatures that Aristotle loved and knew. Moreover, it follows for certain, if all this be true, that Aristotle's biological studies preceded his more strictly philosophical work; and it is of no small importance that we should be (as far as

[1] Perhaps it was here also that Aristotle found his 'Lesbian rule'.

possible) assured of this, when we speculate upon the influence of his biology on his philosophy.[1]

Aristotle is no tyro in biology. When he writes upon Mechanics or on Physics we read him with difficulty: his ways are not our ways; his explanations seem laboured; his science has an archaic look, as it were coming from another world to ours, a world before Galileo. Speaking with all diffidence, I have my doubts as to his mathematics. In spite of a certain formidable passage in the Ethics, where we have a sort of *ethica more geometrico demonstrata,* in spite of his favourite use of the equality of the angles of a triangle to two right angles as an example of proof indisputable, in spite even of his treatise *De Lineis Insecabilibus,* I am tempted to suspect that he sometimes passed shyly beneath the superscription over Plato's door.

But he was, and is, a very great naturalist. When he treats of Natural History, his language is our language, and his methods and his problems are wellnigh identical with our own. He had familiar knowledge of a thousand varied forms of life, of bird and beast, and plant and creeping thing. He was careful to note their least details of outward structure, and curious to probe by dissection into their parts within. He studied the metamorphoses of gnat and butterfly, and opened the bird's egg to find the mystery of incipient life in the embryo chick. He

[1] Pursuing my geographical inquiries a very little further, I have discovered that of the very large number of place-names mentioned in the *Problems*, by far the greater number are situated in Southern Italy, that is to say in Magna Graecia, or in Sicily; and I live in hopes of seeing this work, or a very large portion of it, expunged, for this and other weightier reasons, from the canonical writings of Aristotle. In the treatise *De Plantis*, which is already acknowledged to be spurious, only three or four geographical names, I think, occur; but they likewise are every one of them situated within the bounds of Magna Graecia.

recognized great problems of biology that are still ours to-day, problems of heredity, of sex, of nutrition and growth, of adaptation, of the struggle for existence, of the orderly sequence of Nature's plan. Above all he was a student of Life itself. If he was a learned anatomist, a great student of the dead, still more was he a lover of the living. Evermore his world is in movement. The seed is growing, the heart beating, the frame breathing. The ways and habits of living things must be known: how they work and play, love and hate, feed and procreate, rear and tend their young; whether they dwell solitary, or in more and more organized companies and societies. All such things appeal to his imagination and his diligence. Even his anatomy becomes at once an *anatomia animata*, as Haller, poet and physiologist, described the science to which he gave the name of *physiology*. This attitude towards life, and the knowledge got thereby, afterwards helped to shape and mould Aristotle's philosophy.

I have no reason to suppose that the study of biology 'maketh a man wise', but I am sure it helped to lead Aristotle on the road to wisdom. Nevertheless he takes occasion to explain, or to excuse, his devotion to this study, alien, seemingly, to the pursuit of philosophy. 'Doubtless,' he says,[1] 'the glory of the heavenly bodies fills us with more delight than we get from the contemplation of these lowly things; for the sun and stars are born not, neither do they decay, but are eternal and divine. But the heavens are high and afar off, and of celestial things the knowledge that our senses give us is scanty and dim. On the other hand, the living creatures are nigh at hand, and of each and all of them we may gain ample and certain knowledge if we so desire.

[1] *De Part. Anim.* i. 5.

If a statue please us, shall not the living fill us with delight; all the more if in the spirit of philosophy we search for causes and recognize the evidences of design. Then will Nature's purpose and her deep-seated laws be everywhere revealed, all tending in her multitudinous work to one form or another of the Beautiful.' In somewhat similar words does Bacon[1] retranslate a familiar saying: 'He hath made all things beautiful according to their seasons; also he hath submitted the world to man's inquiry.' On the other hand, a most distinguished philosopher of to-day is struck, and apparently perplexed, by 'the awkward and grotesque, even the ludicrous and hideous forms of some plants and animals'.[2] I commend him, with all respect, to Aristotle—or to that Aristotelian verity given us in a nutshell by Rodin, 'Il n'y a pas de laideur!'

To be sure, Aristotle's notion of beauty was not Rodin's. He had a philosopher's comprehension of the Beautiful, as he had a great critic's knowledge and understanding of Poetry; but wise and learned as he was, he was neither artist nor poet. His style seldom rises, and only in a few such passages as that which I have quoted, above its level didactic plane. Plato saw philosophy, astronomy, even mathematics, as in a vision; but Aristotle does not know this consummation of a dream. The bees have a king, with Aristotle. Had Plato told us of the kingdom of the bees, I think we should have had Shakespearian imagery. The king would have had his 'officers of sorts', his magistrates, and soldiers, his 'singing masons building roofs of gold'. Even Pliny, arid encyclopaedist as he is, can now and then throb and thrill us as Aristotle cannot do—for example, when

[1] *De Sapientia Veterum* (Eccles. iii. 11).

[2] Ward, op. cit., p. 85.

he throws no little poetry and still more of music into his description of the nightingale's song.[1]

But let us now come, at last, to exemplify, by a few brief citations, the nature and extent of Aristotle's zoological knowledge. And here, brevity bids me choose between two ways: either to deal with Aristotle's theories or his facts, his insight or his erudition. The former are of the highest possible interest to us, and their treatment partly includes the latter. But it would take more than all the time I have, to deal with any one of Aristotle's theories—of generation, for instance, or of respiration and vital heat, or those still weightier themes of variation and heredity, the central problems of biology, or again the teleological questions of adaptation and design.

Let me therefore confine myself, almost wholly, to a few fragments out of his storehouse of zoological and embryological facts.

Among the bloodless animals, as Aristotle called what we call the Invertebrates, he distinguishes four great genera, and of these the Molluscs are one. These are the cuttle-fish, which have now surrendered their Aristotelian name of 'molluscs' to that greater group, which is seen to include them with the shell-fish, or 'ostracoderma' of Aristotle. These cuttle-fishes are creatures that we seldom see, but in the Mediterranean they are an article of food, and many kinds are known to the fishermen. All, or wellnigh all, of these common kinds were known to Aristotle, and his account of them has come down to us with singular completeness. He describes their form and their anatomy, their habits, their development, all with such faithful accuracy that what we can add to-day seems of secondary importance. He begins with

[1] *H. N.* x. 43 (29).

a methodical description of the general form, tells us of the body and fins, of the eight arms with their rows of suckers, of the abnormal position of the head. He points out the two long arms of Sepia and of the Calamaries, and their absence in the octopus; and he tells us, what was only confirmed of late, that with these two long arms the creature clings to the rock and sways about like a ship at anchor. He describes the great eyes, the two big teeth forming the beak; and he dissects the whole structure of the gut, with its long gullet, its round crop, its stomach and the little coiled caecal diverticulum; dissecting not only one but several species, and noting differences that were not observed again till Cuvier re-dissected them. He describes the funnel and its relation to the mantle-sac, and the ink-bag, which he shows to be largest in Sepia of all others. And here, by the way, he seems to make one of those apparent errors that, as it happens, turn out to be justified: for he tells us that in Octopus the funnel is on the upper side; the fact being that when the creature lies prone upon the ground, with all its arms spread and flattened out, the funnel-tube (instead of being flattened out beneath the creature's prostrate body) is long enough to protrude upwards between arms and head, and to appear on one side or other thereof, in a position apparently the reverse of its natural one. He describes the character of the cuttle-bone in Sepia, and of the horny pen which takes its place in the various Calamaries, and notes the lack of any similar structure in Octopus. He dissects in both sexes the reproductive organs, noting without exception all their essential and complicated parts; and he had figured these in his lost volume of anatomical diagrams. He describes the various kinds of eggs, and, with still more surprising knowledge, shows us the little embryo cuttle-fish, with its great

yolk-sac, attached (in apparent contrast to the chick's) to the little creature's developing head.

But there is one other remarkable structure that he knew, centuries before it was rediscovered almost in our own time. In certain male cuttle-fishes, in the breeding season, one of the arms develops in a curious fashion into a long coiled whip-lash, and in the act of breeding may then be transferred to the mantle-cavity of the female. Cuvier himself knew nothing of the nature or the function of this separated arm, and indeed, if I am not mistaken, it was he who mistook it for a parasitic worm. But Aristotle tells us of its use and its temporary development, and of its structure in detail, and his description tallies closely with the accounts of the most recent writers.

Among the rarer species of the group he knew well the little Argonaut, with its beautiful cockle-shell, and tells how it puts up its two broad arms to sail with, a story that has been rejected by many, but that after all may perhaps be true.

Now in all this there is far more than a mass of fragmentary information gleaned from the fishermen. It is a plain orderly treatise, on the ways and habits, the varieties, and the anatomical structure of an entire group. Till Cuvier wrote there was none so good, and Cuvier lacked knowledge that Aristotle possessed.

Not less exact and scarcely less copious is the chapter in which Aristotle deals with the crab and lobster, and all such crustacean shell-fish, nor that in which he treats of insects, after their kind. Most wonderful of all, perhaps, are those portions of his books in which he speaks of fishes, their diversities, their structure, their wanderings, and their food. Here we may read of fishes that have only recently been rediscovered,[1] of structures

[1] e.g. *Parasilurus Aristotelis*, a siluroid fish of the Achelous.

only lately reinvestigated, of habits only of late made known.[1] And many such anticipations of our knowledge, and many allusions to things of which we are perhaps still ignorant, may yet be brought to light; for we are still far from having interpreted and elucidated the whole mass of Aristotle's recorded erudition: which whole recorded mass is only, after all, *tanquam tabula naufragii*.

There is perhaps no chapter in the *Historia Animalium* more attractive to the anatomist than one which deals with the anatomy and mode of reproduction of the cartilaginous fishes, the sharks and rays, a chapter which moved to admiration that prince of anatomists Johannes Müller.[2] The latter wrote a volume on the text of a page of Aristotle, a page packed full of a multitude of facts, in no one of which did Johannes Müller discover a flaw. The subject is technical, but the gist of the matter is this: that among these Selachians (as, after Aristotle, we still sometimes call them) there are many diversities in the structure of the parts in question, and several distinct modes in which the young are brought forth or matured. For in many kinds an egg is laid, which eggs, by the way, Aristotle describes with great minuteness. Other kinds do not lay eggs, but bring forth their young alive, and these include the Torpedo and numerous sharks or dogfish. The eggshell is in these cases very thin, and breaks before the birth of the young. But among them there are a couple of sharks, of which one species was within

[1] e.g. the reproduction of the pipe-fishes (Syngnathi), the hermaphrodite nature of the Serrani, the nest-building of the Wrasses, &c., &c.

[2] Cf. Cavolini, in his classical *Mem. sulla Generazione dei Pesci*, Naples, 1787: 'E quando io . . . scorro la Storia degli Animali di Aristotile, non posso non essere da stupore preso, in esse leggendo veduti quei fatti, che a noi non si son potuti che a stento manifestare: e rilevati poi con tutta la nettezza, e posti in parallelo coi fatti già riconosciuti nel feto del gallo;' &c.

Aristotle's reach, where a very curious thing happens. Through the delicate membrane, which is all that is left of the eggshell, the great yolk-sac of the embryo becomes connected with the parental tissues, which infold and interweave with it ; and by means of this temporary union the blood of the parent becomes the medium of nourishment for the young. And the whole arrangement is physiologically identical with what obtains in the higher animals, the mammals, or warm-blooded vivipara. It is true that the yolk-sac is not identical with that other embryonic membrane which comes in the mammals to discharge the function of which I speak ; but Aristotle was aware of the difference, and distinguishes the two membranes with truth and accuracy.

It happens that of the particular genus of sharks to which this one belongs, there are two species differing by almost imperceptible characters ; but it is in one only of the two, the γαλεὸς λεῖος of Aristotle, that this singular phenomenon of the *placenta vitellina* is found. It is found in the great blue shark of the Atlantic and the Mediterranean; but this creature grows to a very large size before it breeds, and such great specimens are not likely to have come under Aristotle's hands. Cuvier detected the phenomenon in the blue shark, but paid little attention to it, and, for all his knowledge of Aristotle, did not perceive that he was dealing with an important fact which the Philosopher had studied and explained. In the seventeenth century, the anatomist Steno actually rediscovered the phenomenon, in the γαλεὸς λεῖος, the *Mustelus laevis* itself, but he was unacquainted with Aristotle. And the very fact was again forgotten until Johannes Müller brought it to light, and showed not only how complete was Aristotle's account, but how wide must have been his survey of this class of fishes to enable

him to record this peculiarity in its relation to their many differences of structure and reproductive habit. I used to think of this phenomenon as one that Aristotle might have learned from the fishermen, but, after a more careful study of Johannes Müller's book, I am convinced that this is not the case. It was a discovery that could only have been made by a skilled and learned anatomist.

In a lengthy and beautiful account Aristotle describes the development of the chick. It is on the third day that the embryo becomes sufficiently formed for the modern student to begin its study, and it was after just three days (a little earlier, as Aristotle notes, in little birds, a little later in larger ones) that Aristotle saw the first clear indication of the embryo. Like a speck of blood, he saw the heart beating, and its two umbilical blood-vessels breaking out over the yolk. A little later he saw the whole form of the body, noting the disproportionate size of head and eyes, and found the two sets of blood-vessels leading, the one to the yolk-sac, the other to the new-formed allantois. In the tiny chick of the tenth day, he saw the stomach and other viscera; he noted the altered position of the heart and great blood-vessels; he traced clearly and fully the surrounding membranes; he opened the little eye to seek, but failed to find, the lens. And at length he describes in detail the appearance and attitude of the little chick, the absorption of the yolk, the shrivelling of the membranes, just at the time when the little bird begins to chip the shell, and before it steps out into the world. While this epitome contains but a part of what Aristotle saw (and without a lens it would be hard to see more than he), it includes the notable fact of the early appearance of the heart, the *punctum saliens* of later writers, whose precedence of all other organs was a chief reason for Aristotle's attributing to it a common,

central, or primary sense, and so locating in it the central seat of the soul. And so it was held to be till Harvey's time, who, noting the contemporaneous appearance of heart and blood, held that the contained was nobler than that which contained it, and that it was the blood that was 'the fountain of life, the first to live, the last to die, the primary seat of the soul, the element in which, as in a fountain-head, the heat first and most abounds and flourishes'; so harking back to a physiology more ancient than Aristotle's—'for the blood is the life thereof.' All students of the *Timaeus* know that here Aristotle parted company with Plato, who, following Hippocrates, and Democritus, and others, placed the seat of sensation, the sovereign part of the soul, in the brain. Right or wrong, it was on observation, and on his rarer use of experiment,[1] that Aristotle relied. The wasp or the centipede still lives when either head or tail is amputated, the tortoise's heart beats when removed from the body, and the heart is the centre from which the blood-vessels spring. To these arguments Aristotle added the more idealistic belief that the seat of the soul, the ruling force of the body, must appropriately lie in the centre: and he found further confirmation of this view from a study of the embryo plant, where in the centre, between the seed-leaves, is the point from which stem and root grow. And Ogle reminds us how, until a hundred years ago, botanists still retained an affectionate and superstitious regard for that portion of the plant, calling it now *cor*, now *cerebrum*, the plant's heart or brain.

And now is it possible to trace directly the influence of Aristotle's scientific training and biological learning upon

[1] Aristotle's experiments were akin to Voltaire's, who employed himself in his garden at Ferney in cutting off the horns and heads of snails, to see whether, or how far, they grew again.

his sociology, his psychology, or in general on his philosophy? That such an influence must have been at work is, prima facie, obvious. The physician who becomes a philosopher will remain a physician to the end; the engineer will remain an engineer; and the ideas of pure mathematics, Roger Bacon's 'alphabet of philosophy', will find issue and expression in the philosophy of such mathematicians as Plato, Leibnitz, Spinoza, or Descartes. Moreover, it is not only the special training or prior avocation of the philosopher that so affects his mind. In divers historical periods the rapid progress or the diffused study of a particular science has moulded the philosophy of the time. So on a great scale in the present day does biology; so did an earlier phase of evolutionary biology affect Hegel; and in like manner, in the great days after Lavoisier, the days of Dalton, Davy and Berzelius, did chemistry help, according to John Stuart Mill, to suggest a 'chemistry of the mind' to the 'association' psychologists. A certain philosopher,[1] in dealing with this theme, begins by telling us that 'Mathematics was the only science that had outgrown its merest infancy among the Greeks'. Now it is my particular purpose to-day to show, from Aristotle, that this is not the case. Whether Aristotle's biological forerunners were many or few, whether or not the Hippocratics (for instance) had failed to raise physiology and anatomy to the dignity of a science, or having done so, had only reserved them, as a secret cult, to their own guild; in short, whether Aristotle's knowledge is in the main the outcome of his solitary labours, or whether, as Leibnitz said of Descartes, *praeclare in rem suam vertit aliorum cogitata*, it is at least certain that biology was in *his* hands a true and comprehensive science, only second to the mathematics of his age.

[1] Ritchie, *Darwin and Hegel*, p. 39.

The influence, then, of scientific study, and in particular of Biology, is not far to seek in Aristotle's case. It has ever since been a commonplace to compare the state, the body politic, with an organism, but it was Aristotle who first employed the metaphor. Again, in his exhaustive accumulation and treatment of political facts, his method is that of the observer, of the scientific student, and is in the main inductive. Just as, in order to understand fishes, he gathered all kinds together, recording their forms, their structure, and their habits, so he did with the Constitutions of cities and of states. Those two hundred and more πολιτεῖαι which Aristotle laboriously compiled, after a method of which Plato would never have dreamed, were to form a Natural History of Constitutions and Governments. And if we see in his concrete, objective treatment of the theme a kinship with Spencer's Descriptive Sociology, again, I think, a difference is soon apparent, between Spencer's colder catalogue of facts and Aristotle's more loving insight into the doings and into the hearts, into the motives and the ambitions, of men.

But whatever else Aristotle is, he is the great Vitalist, the student of the Body with the Life thereof, the historian of the Soul.

Now we have already seen how and where Aristotle fixed the soul's seat and local habitation. But the soul has furthermore to be studied according to its attributes, or analysed into its 'parts'. Its attributes can be variously analysed, as in his *Ethics* Aristotle shows. But it is in the light of Biology alone that what amounts to a scientific analysis, such as is developed in the *De Anima*, becomes possible; and in that treatise it is only after a long preliminary physiological discussion that Aristotle at length formulates his distinctive psychology. There is a principle of continuity, a συνέχεια, that runs

through the scale of structure in living things, and so, little by little, by imperceptible steps, does Nature make the passage from plant, through animal, to man. It is with all the knowledge, summarized in a great passage of the *Natural History*, and embodied in this broad generalization, that Aristotle afterwards proceeds to indicate the same gradation in psychology, and to draw from it a kindred classification of the Soul.

There is a soul which presides over the primary physiological requirement of nutrition, a soul already inherent in the plant and inseparable from life itself; it is ἡ πρώτη ψυχή. Common likewise to all living things are the physiological functions of growth and reproduction, and the psychical agencies directing these are concomitant with, and in fact identical with, the nutrient soul. Sensation or sensibility, whereby the animal essentially differs from the plant, distinguishes the αἰσθητικὴ ψυχή, the sentient soul; and the soul of movement, undisplayed in the very lowest of animals, presently accompanies the soul of sensibility. At length the reasoning soul, the διανοητικὴ ψυχή, or νοῦς, emerges in man, as the source of his knowledge and his wisdom.[1] In a brief but very important passage,[2] with a touch of that Platonic idealism never utterly forgotten by him (and so apt to bring Wordsworth to our own minds), Aristotle tells us that this soul 'cometh from afar'—μόνον θύραθεν ἐπεισιέναι, καὶ θεῖον εἶναι μόνον. Yes, in very plain Greek prose, this is no less than to assert that 'trailing clouds of glory', 'it cometh from afar.'

But however glorified be the reasoning soul, yet these parts, these subdivisions of the soul, do not stand apart in

[1] I have here borrowed some words from a former address, and from my notes on the *Historia Animalium*.

[2] *De Gen. An.* ii. 3, 736 b 27. Cf. Brentano, *Aristoteles' Lehre vom Ursprung des menschlichen Geistes*, 1911, p. 18.

mutual exclusiveness, but just as we may discern a triangle within a square, so is each lower grade of ψυχή implicit in the higher. And as the higher organisms retain the main physiological faculties of the lower, so do they retain such psychological qualities as these possess: and gradually (more and more as we ascend the ladder) do we find adumbrations of the psychical qualities that will be perfected in the higher forms. Among the higher animals, at least, a comparative psychology may be developed; for just as their bodily organs are akin to one another's and to man's, so also have we in animals an inchoate intelligence, wherein we may study, in one or another, the psychology of such things as fear, anger, courage, and at length of something which we may call sagacity, which stands not far from reason. And, last of all, we have a psychology of childhood, wherein we study in the child, at first little different from the animal, the growing seeds of the mind of man.

But observe before we leave this subject that, though Aristotle follows the comparative method, and ends by tracing in the lower forms the phenomena incipient in the higher, he does not adopt the method so familiar to us all, and on which Spencer insisted, of first dealing with the lowest, and of studying in successive chronological order the succession of higher forms. The historical method, the realistic method of the nineteenth century, the method to which we so insistently cling, is not the only one. Indeed, even in modern biology, if we compare (for instance) the embryology of to-day with that of thirty years ago, we shall see that the pure historical method is relaxing something of its fascination and its hold. Rather has Aristotle continually in mind the highest of organisms, in the light of whose integral and constituent phenomena must the less perfect be understood. So was

it with one whom the Lord Chancellor of England has called 'the greatest master of abstract thought since Aristotle died'. For Hegel,[1] as surely for Aristotle also, *Entwicklung* was not a 'time-process but a thought-process'. To Hegel, an actual, realistic, outward, historical evolution seemed but a clumsy and materialistic philosophy of nature. In a sense, the 'time-difference has no interest for thought'. And if the lower animals help us to understand ourselves, it is in a light reflected from the study of Man.

So grows up, upon a broad basis of Natural History, the whole psychology of Aristotle, and in particular that great doctrine of the tripartite soul, according to which created things 'by gradual change sublimed, To vital spirits aspire, to animal, To intellectual!'

In this ψυχή of Aristotle there was (in spite of the passage which I have quoted) a trace of the concrete and the all but material, which later Greek as well as Christian thought was not slow to discern and to modify. But, as a philosopher of our own day reminds us, it was in relation to a somewhat idealized Body that Aristotle described that somewhat unspiritual Soul. Such as it is, it has remained at the roots of our psychology, even to this day.

Bergson only partially gets rid of it when he recasts Aristotelian psychology on the lines of that branching tree which modern evolutionary biology substitutes for the *scala Naturae* of Aristotle; and when he sees, for instance, in psychological evolution, not the successive grades of continuous development, through sensibility and instinct to intelligence, but rather the splitting up of an original activity, of which instinct

[1] Ritchie, op. cit. Cf. Höffding, in *Darwin and Modern Science*. Cambridge, 1909, p. 449.

and intelligence are not successive, but separate and diverging, outgrowths.

In our recent science the Aristotelian doctrine is not dead. For but little changed, though dressed in new garments, this Aristotelian *entelechy*,[1] which so fascinated Leibnitz,[2] enters into the Vitalism of Hans Driesch; and of those who believe with him, that far as physical laws may carry us, they do not take us to the end: that the limitations of induction forbid us to pass in thought and argument from chemistry to consciousness, or (as Spencer well knew) from Matter to Mind;[3] that Life is not merely 'an outstanding difficulty, but a veritable exception to the universal applicability of mechanical laws'; that not to be comprehended under the category of physical cause, but to be reckoned with apart, is the fundamental conception underlying Life and its Teleology.[4]

It is easy so to sketch in simple words the influence of Aristotle's biological studies upon his method of work, or to see in his Psychology and his Ethics the results of his biological analysis of the soul. But his natural science seems to send a still deeper influence running through the whole of his philosophy, for better or for worse, which

[1] ψυχή ἐστιν ἐντελέχεια ἡ πρώτη σώματος φυσικοῦ δυνάμει ζωὴν ἔχοντος.

[2] Cf. Jacoby, *De Leibnitii studiis Aristotelicis*, Berlin, 1867.

[3] Cf. Spencer, *Princ. of Psychology* (para. 63): 'Though of the two it seems easier to translate so-called Matter into so-called Spirit, than to translate so-called Spirit into so-called Matter (which latter is indeed wholly impossible); yet no translation can carry us beyond our symbols. Such vague conceptions as loom before us are illusions conjured up by the wrong connotations of our words.'

[4] Cf. Kant's views in the *Kritik der Urteilskraft* and elsewhere, on the teleological aspect of living organisms, with (for instance) Schleiden in the Preface to his *Grundzüge der Botanik* (1860): '. . . durch die Darwinsche Lehre die Teleologie aus der Naturwissenschaft vollständig heraus, und in die erbauliche oder poetische Rede, wo sie hingehört, verwiesen wurde!' Cf. also Professor Sidgwick's remarks on Spencer's 'avoidance of teleological explanation', in the *Ethics of T. H. Green*, &c., p. 141.

influence I lack the needful learning to fathom and to describe. I can only see dimly, and cannot venture to explain, how his lifelong study of living things led to his rejection of Plato's idealistic ontology, and affected his whole method of classification, his notion of essentials and accidents, his idea of 'Nature' that 'makes nothing in vain', his whole analysis of causation, his belief in, and his definition [1] of, Necessity, his faith in design, his particular form of teleology, his conception and apprehension of God.

And now, to close my story. It is in no derogation of Spencer's commemorative honour that I have spoken of him together with a greater Philosopher, and one of the greatest of men. So I have used my hour of Oxford to speak, and to salute, the name of Aristotle, here where his spirit has dwelt for six hundred years—I who have humbly loved him since my day began.

We know that the history of biology harks back to Aristotle by a road that is straight and clear, but that beyond him the road is broken and the lights are dim. And we have seen that biology was no mere by-play of Aristotle's learned leisure, but was a large intrinsic part of the vast equipment of his mind.

This our science is no petty handicraft, no narrow discipline. It was great, and big, in Aristotle's hands, and it is grown gigantic since his day.

It begins in admiration of Nature's handiwork, as she strews it by the way. It bids us seek through the land, and search the deep places of the sea. It toils for the health and wealth of men. It speaks of things humble; it whispers of things high. It tells (if I dare use the old theologian's word [2]) of Laws, 'whose Voice is the harmony of the World, and whose Seat is the bosom of God.'

[1] τὸ μὴ ἐνδεχόμενον ἄλλως ἔχειν. [2] Hooker.

Sometimes, as to-day, it brings us by a by-way to the study of the history of human thought and knowledge, and introduces us to a company of great men, dwellers in the 'clear air' of Athens.

The little Greek I know, first learnt at my Father's knee, is but a child's plaything to that of many a scholar here. But I hear, now and then, a welcome given, in old Hellenic speech, to men who call at that Interpreter's House wherein Plato and Aristotle show us 'excellent things, such as will be a help to us in our journey'.

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SPENCER'S PHILOSOPHY OF SCIENCE

THE HERBERT SPENCER LECTURE

DELIVERED AT THE MUSEUM

7 NOVEMBER, 1913

BY

C. LLOYD MORGAN, F.R.S.

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SPENCER'S PHILOSOPHY OF SCIENCE

Towards the close of 1870, while I was still in my teens, my youthful enthusiasm was fired by reading Tyndall's Discourse on *The Scientific Use of the Imagination.* The vision of the conquest of nature by physical science—a vision which had but lately begun to open up to my wondering gaze—was rendered clearer and more extensive. Of the theory of evolution I knew but little; but I none the less felt assured that it had come to stay and to prevail. Was it not accepted by all of *us*—the enlightened and emancipated men of science whose ranks I had joined as a raw recruit? Believing that I was independently breaking free of all authority, to the authority that appealed to my fancy, and to a new loyalty, I was a willing slave. And here in one glowing sentence the inner core of evolution lay revealed.

> 'Strip it naked and you stand face to face with the notion that not alone the more ignoble forms of animalcular and animal life, not alone the nobler forms of the horse and the lion, not alone the exquisite and wonderful mechanism of the human body, but that the human mind itself—emotion, intellect and all their phenomena—were once latent in a fiery cloud.'[1]

With sparkling eyes I quoted these brave words to a friend of my father's, whose comments were often as caustic as his sympathy in my interests was kindly. With a grave smile he asked whether the notion was not perhaps stripped too naked to preserve the decencies of modest thought; he inquired whether I had not

learnt from *Sartor Resartus* that the philosophy of nature is a Philosophy of Clothes; and he bade me devote a little time to quiet and careful consideration of what Tyndall really meant—meant in terms of the exact science he professed—by the phrase 'latent in a fiery cloud'. I dimly suspected that the old gentleman—old in the sense of being my father's contemporary—was ignorant of those recent developments of modern science with which I had been acquainted for weeks, nay more for months. Perhaps he had never even heard of the nebular hypothesis! But I felt that I had done him an injustice when, next morning, he sent round a volume of the *Westminster Review* with a slip of paper indicating an article on 'Progress: its Law and Cause'.

Such was my introduction to Herbert Spencer, some of whose works I read with admiration during the next few years.

I have no very distinct recollection of the impression produced on my mind by the germinal essay of 1857, save that it served to quicken that craving, which is, I suppose, characteristic of those who have some natural bent towards philosophy—the imperative craving to seek and, if it may be, to find the one in the many. In any case Tyndall's suggestive sentence was here amplified and the underlying law was disclosed.

> 'Whether it be in the development of the Earth, in the development of Life upon its surface, in the development of Society, of Government, of Manufacture, of Commerce, of Language, Literature, Science, Art, the same evolution of the simple into the complex, through successive differentiations, holds throughout. From the earliest traceable cosmical changes down to the latest results of civilisation, we shall find that the transformation of the homogeneous into the heterogeneous, is that in which Progress essentially consists.'[2]

Here was just what I wanted—on the one hand the whole wide universe of existence; and on the other hand a brief formula with which to label its potted essence. How breathlessly one was led on, with only such breaches of continuity as separate paragraphs inevitably impose, right away from the primitive fire-mist to one of Bach's fugues or the critical doctrines of Mr. Ruskin, guided throughout by the magic of differentiation. What if the modes of existence, dealt with in successive sections, were somewhat startlingly diverse! Was not this itself a supreme example of the evolution of that diversity which the formula enables us to interpret? For if there were a passage from the homogeneous to the heterogeneous, the more heterogeneous the products—inorganic, organic, and superorganic, as I learnt to call them—the stronger the evidence for the law. Only by shutting one's eyes to the light that had been shed on the world by evolution could one fail to see how simple and yet how inevitable was the whole business.

If then differentiation be the cardinal law of evolution—for the correlative concept of integration receives no emphasis in this early essay—does not the universality of the law imply a universal cause? Just as gravitation was assignable as a *cause* of each of the groups of phenomena which Kepler formulated; so might some equally simple attribute of things be assignable as the cause of each of the groups of phenomena formulated in terms of differentiation. Now the only obvious respect in which all kinds of Progress are alike, is, that they are modes of change; and hence in some characteristic of changes in general, the desired solution must be found. Thus we are led up to the statement of the all-pervading principle which determines the all-pervading process of

differentiation. It is this: *Every active force produces more than one change—every cause produces more than one effect.*[3]

In the first part of the Essay many and varied facts are adduced to show that every kind of progress is from the simple to the complex. The aim of the second part is to show why this is so: it is 'because each change is followed by many changes'. From the beginning, the decomposition of every expended force into several forces has been perpetually producing a higher complication, and thus Progress is not an accident but a beneficent necessity. In a brief third part we are bidden to remember that

> 'after all that has been said the ultimate mystery remains just as it was. The explanation of that which is explicable does but bring out into greater clearness the inexplicableness of that which remains behind. . . . The sincere man of science, content to follow wherever the evidence leads him becomes by each new enquiry more profoundly convinced that the Universe is an insoluble problem. . . . In all directions his investigations bring him face to face with the unknowable; and he ever more clearly perceives it to be the unknowable'.[4]

There is I think a growing consensus of opinion that the first of these three parts, subsequently expanded and illustrated with astonishing wealth of detail in the volumes of the *Synthetic Philosophy*, contains the germ of all that is best in the teaching of Herbert Spencer; and that it was amid phenomena which admitted of interpretation from the biological, or quasi-biological, point of view that he found his most congenial sphere of work and the one in which his method was most effectively employed. The story of evolution is the story of inter-related changes. In any organic whole

there are certain salient features of the historical sequence.[5] The parts get more different from each other, and they also get more effectively connected with each other; the individual whole gets more different from its environment, and it also preserves and extends its connexion with the environment; the several individuals get more different from others, while their connexion with others is retained and new connexions are established. Nowadays these central ideas may seem familiar enough; but that is just because Spencer's thought has been so completely assimilated. And then we must remember that these main principles are supplemented by a great number of ancillary generalizations, many of which have been incorporated in the scientific doctrine which is current to-day. We must bear in mind that of the *Biology* Charles Darwin wrote:[6] 'I am astonished at its prodigality of original thought.' Of the *Psychology* William James says[7] that of the systematic treatises it will rank as the most original. These are the opinions of experts. No discussion of sociology or ethics is complete if it ignores Spencer's contributions to these subjects. The *Ethics*, says James[8] is a most vital and original piece of attitude-taking in the world of ideals. It was his firm and often inflexible 'attitude' which was a source of strength in Spencer, though it was the strength of rigidity rather than that of sinewy suppleness. This was part of a certain 'narrowness of intent and vastness of extent' which characterized his mental vision. He was so obsessed with the paramount importance of biological relationships that in his *Sociology*, his *Ethics*, his *Psychology*, he failed to do justice to, or even to realize the presence of, other and higher relationships—higher, that is, in the evolutionary scale. But it was his signal

merit to work biological interpretation for all, and perhaps more than, it was worth. It was on these lines that he was led to find a clue to those social and political developments, the discussion of which, in the *Nonconformist* of 1842, constituted the first step from the life of an engineer to that other kind of life which led to the elaboration of the *Synthetic Philosophy*.[9] In his later years he was saddened to see that many of the social and political doctrines, for the establishment of which he had striven so strenuously, were not accepted by a newer generation of thinkers. Still, to have taken a definite and, for all his detractors may say, an honoured position in the line of those who make history in the philosophy of life and mind—that could never be taken away from him.

It will perhaps be said that this emphasis on the philosophy of life and mind does scant justice to the range and sweep of Spencer's philosophy as a whole; and no doubt others will contend that the emphasis should be laid elsewhere; on the mechanical foundations; on evolution as a universal principle. It will be urged that Spencer widened to men's view the scope of scientific explanation. He proclaimed 'the gradual growth of all things by natural processes out of natural antecedents'.[10] Even in the *Nonconformist* letters 'there is', he himself says,[11] 'definitely expressed a belief in the universality of law—law in the realm of mind as in that of matter—law throughout the life of society as throughout the individual life. So, too, is it with the correlative idea of universal causation.' And if there be law it must at bottom be one law. Thus in *First Principles* Spencer propounded a sweeping and sonorous formula, which every disciple knows by heart, embodying the fundamental traits of that unceasing

redistribution of matter and motion which characterizes evolution as contrasted with dissolution. Was it not this that he himself regarded as his main contribution to philosophy? Did he not himself provide a summary, setting forth the sixteen articles of the Spencerian creed; and is not this summary given a prominent position in the Preface he wrote to Howard Collins's *Epitome of the Synthetic Philosophy*? Do not these fundamental articles of his faith deal with ubiquitous causes, with the instability of the homogeneous and the multiplication of effects, with segregation and equilibration, and with the basal conception of the persistence of force? There is here, it may be said, no special reference to the organic and the superorganic. And why? Just because Spencer's interpretation is all-inclusive; because biology, psychology, sociology, ethics are, broadly considered, concerned only with incidents of the later scenes of the great mechanical drama of evolution. Are we not again and again bidden, now in forecast, now in retrospect, to look below the surface, and constantly to bear in mind that the aim of philosophy, as completely unified knowledge, is 'the interpretation of all phenomena in terms of Matter, Motion, and Force'?[12] It is true that the affairs of the mind give pause and seem to present something of a difficulty. But even here 'specifically stated, the problem is to interpret mental evolution in terms of the redistribution of matter and motion'.[13] An adequate explanation of nervous evolution involves an adequate explanation of the concomitant evolution of mind. It is true that the antithesis of subject and object is never to be transcended 'while consciousness lasts'.[14] But if all existence, distinguishable as subjective, is resolvable into units of consciousness, which in their obverse or objective aspect are oscillations of mole-

cules,[15] what more is required to round off the explanation of every thing, save the Unknowable—save the Ultimate Reality in which subject and object are united? In the end we are baffled by mystery; let us, therefore, make the best of it and rejoice.

> 'We can think of Matter only in terms of Mind. We can think of Mind only in terms of Matter. When we have pushed our explorations of the first to its uttermost limit we are referred to the second for a final answer; and when we have got the final answer to the second we are referred back to the first for an interpretation of it.'[14]

And so neither answer is final. Finality is only reached when both are swallowed up, not in victory, but in defeat. Shall we not then glory in defeat and sing its praises often?

I must leave to some future Herbert Spencer lecturer the discussion of his doctrine of the Unknowable and the critical consideration of its place and value in philosophy. I would fain leave it altogether on one side; but that is impossible. Although the *First Principles* is divided into two Parts, dealing respectively with the Unknowable and the Knowable, we have not by any means done with the former when we turn from the First Part to the Second. With Spencer we have never done with the Unknowable, the Unconditioned Reality and the other aliases by which it goes. His persistence of force is the persistence of Unknowable Force. In a leading passage, at any rate, it is avowedly 'the persistence of some Cause which transcends our knowledge and conception. In asserting it we assert an Unconditioned Reality without beginning or end'.[16] There must, he holds, be something at the back of the evolutionary drama which we study—something that

is both a principle of activity and a permanent *nexus*.[17] The pity of it is that we know not, and can never know, what on earth (or in heaven!) it is. We only know that it exists, and somehow produces the whole show. Now it would much conduce to clearness of thought and of statement if we could agree to eliminate those terribly ambiguous words 'force' and 'cause' when we are dealing with the fundamental postulate (if such it be) that there must be something at the back of evolution to make it what it is; and the word Source seems ready to our hand and might well be given this special significance. But Spencer uses Agency, Power, Cause, Force, in this connexion. In how many senses he uses the word 'force' I am not prepared to say. It is often a synonym for cause; it stands alike for matter and energy;[18] it is the objective correlate of our subjective sense of effort.[19] There is a 'correlation and equivalence between external forces and the mental forces generated by them under the form of sensations'.[20] And when we pass to human life in society, whatever in any way facilitates or impedes social, political, or economic change, is spoken of in terms of force.[21] With an apparent vagueness and laxity almost unparalleled, force is used in wellnigh every conceivable sense of this ambiguous word—except, perhaps, that which is now sanctioned by definition in mathematical physics. I say apparent vagueness and laxity because, subtly underlying all this varied usage, is the unifying conception of Source as the ultimate basis of all enforcement. From this flows all necessity whether in things or thoughts or any combination of the two. Thus persistence of force is Spencer's favourite expression for uniform determinism at or near its Source.

Now, as I understand the position, science has nothing

whatever to do with the Source or Sources of phenomena. By a wise self-denying ordinance it rules all questions of ultimate origin out of court. It regards them as beyond its special sphere of jurisdiction. It deals with phenomena in terms of connexion within an orderly scheme, and it does not profess to explain *why* the connexions are such as they are found to be. In any discussion of this or that sequence of events which may fall under the wide and rather vague heading of evolution, it is just a consistent story of the events in their total relatedness that science endeavours to tell. The question: But what evolves the evolved? is for science (or should I say for those who accept this delimitation of the province of science?) not so much unanswerable in any terms, as unanswerable in scientific terms. For the terms in which an answer must be given are incommensurable with the concepts with which science has elected to carry on its business as interpreter of nature. To this question therefore the man of science, speaking for his order, simply replies: We do not know. Is this, then, Spencer's answer? Far from it. The man of science here makes, or should make, no positive assertion, save in respect of the limits of his field of inquiry. If you beg him to tell you what that which he knows not is, or does, he regards such a question as meaningless. But Spencer's Unknowable, notwithstanding its negative prefix, is the Ultimate Reality, and does all that is in any way done. We may not know *what* it is; but *that* it is, is the most assured of all assured certainties. And when it comes to doing, what can be more dramatically positive than that which bears a name of negation? Whatever it may not be, it is the Power that drives all the machinery in this workshop of a world; it is the Power which lies at

the back of such wit as man has to interpret it, and, in some measure, to utilize its mechanism.

It seems plain enough that Spencer distinguishes, or seeks to distinguish, between those knowable effects which we call natural phenomena and their Unknowable Cause or Source. And this seems to be in line with the distinction which his critic, M. Bergson, draws between 'the evolved which is a result' and 'evolution itself, which is the act by which the result is obtained'.[22] An act implies an agent, and the agency of which the evolved is a manifestation is for M. Bergson Life, while for Spencer it is that very vigorous agency—the Unknowable. Now in criticizing Spencer, M. Bergson says:

> 'The usual device of the Spencerian method consists in reconstructing evolution with the fragments of the evolved. . . . It is not however by dividing the evolved that we shall reach the principle of that which evolves. It is not by recomposing the evolved with itself that we shall reproduce the evolution of which it is the term.'[23]

But does Spencer ever suggest that we shall thus reach the principle of that which evolves—by which, if I mistake not, M. Bergson means the Source of evolution? Does he not urge that we can neither reach it in this way, nor in any other way? For M. Bergson, as for Spencer, it is unknowable by the intellect—it can only be known by what M. Bergson calls intuition. For both thinkers, the intellect provides only a world of symbols; and Spencer's transfigured realism may be matched by what Dr. Wildon Carr calls M. Bergson's transformed realism.[24] So long as we are dealing with the evolved—which is that with which alone science attempts to deal—Spencer, M. Bergson, and the rest

of us are in like case. We must stumble on intellectually with our symbols as best we may. 'Whether we posit the present structure of mind or the present subdivision of matter in either case we remain in the evolved: we are told nothing of what evolves, nothing of evolution.'[25] *Nothing of what evolves!* Spencer might exclaim with a groan. Have I then written all those pages and pages on the Unknowable for nought? Is it not a fundamental tenet of my philosophy that there must be, and therefore is, a Source of the evolved—of the phenomenal world which is merely an expression in terms of intellectual symbolism, of that ultimate Power which, though its nature may baffle the intellect, is none the less the most real of all realities?

It would take us too far from the line of Spencer's thought to consider M. Bergson's doctrine that it is the intellect that portions the world into lots;[26] that cuts the facts out of the interpenetrating whole of reality, and renders them artificially distinct within the continuity of becoming. It suffices to note that on such a presupposition 'the cardinal error of Spencer is to take experience already allotted as given, whereas the true problem is to know how the allotment was worked'.[27] I am not prepared to give—indeed I have been unable to find—M. Bergson's own solution of the problem. I gather that it was Life itself that somehow allotted concepts and objects in such correspondence as should be practically useful though metaphysically false and illusory. But just how it was done I have still to learn. 'The original activity was', we are told, 'a simple thing which became diversified through the very construction of mechanisms such as those of the brain,'[28] which, as Life's tool, has facilitated the chopping up of a continuous interpenetrating reality into mince-meat

for intellectual assimilation. Such a conception was foreign to Spencer's thought. But some of us may find it hard to distinguish M. Bergson's 'original activity' from Spencer's Unknowable, which, so far as one can make out, somehow produced precisely the same results. As a matter of fact, M. Bergson seems to put into Life, as Spencer put into the Unknowable, the potentiality of producing all that actually exists.

For Spencer, as for M. Bergson, we live in a world of change. But neither is content to accept changes as facts to be linked up within a scheme of scientific interpretation. Both must seek their Source. Now to inquire into the Source or Sources of phenomena is characteristic of man as thinker. And if, in common with those whom I follow, I regard this quest as beyond the limits of science, I am well aware that such delimitation of fields of inquiry is by no means universally accepted. M. Bergson, for example, regards metaphysics as the *Science*[29] which claims to dispense with symbols, which turns its back on analysis, which eschews logic, which dispenses with relativity and pierces to the absolute, which, apparently, uses the intellect only to establish its utter incompetence in this department of 'science'. Merely saying that this, whatever else it may be, is not what I, for one, understand by science—and not, by the way, what M. Bergson in other passages seems to mean by science[30]—I pass on to Spencer's treatment of the philosophy of science which, for him, is 'completely unified knowledge', 'the truths of philosophy bearing the same relation to the highest scientific truths that each of these bears to lower scientific truths.'

I suppose one of the basal truths in his philosophy of science is for Spencer the universality of connexion between cause and effect. Now let us eliminate Source

as the Ultimate Cause (so far as that is possible in Spencer); let us restrict our attention to cause and effect in the realm of the knowable. When we try to do this we find his statements concerning them scarcely less puzzling than those that refer to force, with which cause is so often identified. Thus we are told[31] that 'motion set up in any direction is itself a cause of further motion in that direction since it is a manifestation of a surplus force in that direction'; and elsewhere[32] that 'the momentum of a body causes it to move in a straight line and at a uniform velocity'. A distinction is drawn between cause and conditions. But both produce effects, and only on these terms can there be that 'proportionality or equivalence between cause and effect' on which Spencer insists.[33] There is, however, scarcely a hint of what constitutes the difference between cause and conditions, save in so far as he speaks[34] of 'those conspicuous antecedents which we call the causes' and 'those accompanying antecedents which we call the conditions'. Many of the details of his treatment I find most perplexing; but to recite examples would be wearisome. And then, in the ninth and tenth articles of the Spencerian creed, cause plays a somewhat different part. For, there, the instability of the homogeneous and the multiplication of effects are given as the chief causes which 'necessitate' that redistribution of matter and motion of which evolution is one phase. Similarly, as I have noted above, in 'Progress: its Law and Cause', the fundamental attribute of all modes of change—that every cause produces more than one effect—is itself spoken of as a cause, and likened to 'gravitation as the cause of each of the groups of phenomena which Kepler formulated'. In these cases a generalization is regarded as the cause of the phe-

nomena from which the generalization is drawn. But sometimes it is spoken of as the reason for the phenomena.[35] Here again, however, as throughout his work, reference to Source is close at hand. Hence, in place of the words cause and force, the word agency[36] sometimes stands for that which produces effects; or the word factor may be used. Thus we are told[37] of 'phenomena continually complicating under the influence of the same original factors'; and we meet with the argument (contra Huxley) that states of consciousness are factors, that is, they 'have the power of working changes in the nervous system and setting up motions'.[38] Always close at hand, constantly underlying Spencer's thought, is the notion of power which works changes. In his treatment of the philosophy of science we are never far from the noumenal Source of phenomena.

> 'For that interpretation of things which is alone possible for us this is all we require to know—that the force or energy manifested, now in one way now in another, persists or remains unchanged in amount. But when we ask what this energy is, there is no answer save that it is the noumenal Cause implied by the phenomenal effect.'[39]

Was it partly with Spencer in view that Mr. Bertrand Russell recently urged[40] that the word cause 'is so inextricably bound up with misleading associations as to make its complete extrusion from the philosophical vocabulary desirable'? Professor Mach[41] had previously expressed the hope 'that the science of the future will discard the use of cause and effect as formally obscure'. And as long ago as 1870 W. K. Clifford[42] tried to show in 'what sort of way an exact knowledge of the facts would supersede an enquiry after the causes of them'; and urged that the hypothesis of continuity 'involves

such an interdependence of the facts of the universe as forbids us to speak of one fact or set of facts as the cause of another fact or set of facts'. Such views may, perhaps, be regarded as extreme; and the word cause is not likely to be extruded from the vocabulary of current speech, of the less exact branches of science, or of general discussions of world-processes. Still, a philosophy of science must take note of this criticism of the use of a term which is, to say the least of it, ambiguous. We must at any rate try to get rid of ambiguity. Now we live in a world of what, in a very broad and inclusive sense, may be called things; and these things are in varied ways related to each other. (I must beg leave to assume, without discussion, that the relatedness of things is no less constitutive of the world with which a philosophy of science has to deal than the things which are in relation.) And when things stand in certain kinds of relatedness to each other changes take place. The trouble is that the kinds of relatedness are so many and the kinds of change are also so many! Spencer tried to reduce all kinds of relatedness to one quasi-mechanical type; and he signally failed—or shall I say that he succeeded only by ignoring all the specific differences on the one hand, and, on the other hand, by so smudgy an extension of the meaning of mechanical and physical terms as to make them do duty in every conceivable connexion?

So long as we can deal with simple types of relatedness, such as that which we call gravitative, in any given system of things regarded as isolated, we can express in formulae not only the rate of change within the system, but also the rate at which the rate of change itself changes. And these formulae are found to be generally applicable where like things are in a like field of relatedness. So that Spencer's persistence of force (at least in

one of its many meanings) is replaced in such cases by sameness of differential equations. And in such cases we have no need for the word cause. Of course the value of the constants in any such formula depends upon the nature of the field of relatedness and of the things therein; and only certain systems, in which the relations are simple, or are susceptible of simplification, can be dealt with, at present, in this manner. It is imperative to remember that not only the rate of change but the kind of change differs in different relational fields—a fact of which Spencer took too little cognizance, so bent was he on some sort of unification at all hazards. Revert now to a field of gravitative relatedness, in which the motion of things is the kind of change, while the rate of change is expressible in a formula; may we not say that the co-presence of things in this relationship does imply certain motions and changes of motion within the system to which the term gravitative applies? There seems little room for ambiguity if we call what is thus implied the effect, and if we term those modes of relatedness which carry this kind of implication, effective. It may, however, be said that it sounds somewhat strange to speak of relations as effective. How can mere relatedness as such *do* anything? What is implied by the effect is surely, it will be urged, a cause in the full and rich sense of the word—a cause which produces the effect. For what is here suggested is nothing more than a generalized statement of the truth that the relational constitution of the system being what it is, the changes are what they are! And so we come back to the conception of an agency which in some way produces the observable change—of a power which is active behind the phenomenal scene—of force and cause in the Spencerian sense. But, so far as scientific interpre-

tation is concerned, this reference to Source—for such it really is—is useless. The gravitative system can be dealt with scientifically just as well without it as with it.

What, then, becomes of the scientific conception of energy? Is not energy that which produces observable change? Is it not active in the sense required? And can we say that this conception is useless for scientific interpretation? I suppose most of us, in our student days, have passed through the phase of regarding energy as an active demon which plays a notorious part in the physical drama. Spencer loved it dearly. But some of us, under what we consider wiser guidance, hold that what we should understand by kinetic energy is nothing of this sort. It is a constant ratio of variables, conveniently expressed as $\frac{1}{2}mv^2$. That, however, it may be said, is absurd. Energy is not merely a ratio or a formula; it is something much more real; perhaps the most real of all the realities the being of which has been disclosed by physical science. Granted in a sense, and a very true sense. But what is this reality? It is the reality of the changes themselves in those fields of relatedness to which the formula has reference. There is nothing, I conceive, in the modern treatment of energy that affords any scientific justification of the Spencerian view [43] that energy is an agent through the activity of which the constant ratio of variables is maintained in the physical world.

I feel sure that it will still be said that change must inevitably imply that which produces change, and that, even if energy be only a ratio of variables within a changing field, there is still the implication of Force as the real Cause of which the change itself, however formulated, is the effect. No doubt this is one of the meanings which the ambiguous words force and cause

may carry. It is to remove this ambiguity that I have suggested that the word Source should be substituted for cause in this sense. And what about force? In one of its meanings it now generally stands for a measure of change. For those who accept Source as a scientific concept it may well stand for the measure or degree of its activity gauged by the phenomenal effect; for those who do not accept it, the measure or degree of the change itself[44]—to be dealt with in mechanics in terms of mass and acceleration. This leaves outstanding, however, the use of the word force in the phrase—the forces of nature—gravitative force, cohesive force, electromotive force, and so on. It was, I take it, with this usage in view that Spencer spoke of vital, mental, and social forces. Now the reference in each of these cases is to some specific mode of relatedness among the things concerned. We need to name it in some way; and this is the way that is, rather unfortunately, sanctioned by custom and long usage. When we say that a thing is in a field of electromotive force we mean (do we not?) that the relatedness is of that particular kind named electromotive, and not of another kind. When Spencer spoke of social forces he had in view changes which take place within a field of social relationships. We do not really need the word force in this sense, since the term relatedness would suffice, and has no misleading associations. But there it is: our business should be to understand clearly what it means. It does not, or should not, I think, mean more, in this connexion, than a particular kind of relatedness in virtue of which an observable kind of change occurs.

We may now pass to cause and conditions. When Spencer distinguishes between those conspicuous antecedents which we call the causes and those accompany-

ing antecedents which we call the conditions, he invites the question: What, then, is the essential difference between them? If the accompanying antecedents are distinguished as inconspicuous, we surely need some criterion of the distinction. Furthermore, inconspicuous conditions are, in science, every whit as important as those which are conspicuous. Now we all know that Mill regarded the cause as 'the sum total of the conditions positive and negative taken together'.[45] But he expressly distinguishes between *events* and *states*.[46] Discussing, for example, the case of a man who eats of a particular dish and dies in consequence, he says:

> 'The various conditions, except the single one of eating the food, were not events but states possessing more or less of permanency, and might therefore have preceded the effect by an indefinite length of duration, for want of that event which was requisite to complete the required concurrence of conditions.'

Again he says:

> 'When sulphur, charcoal, and nitre are put together in certain proportions and in a certain manner, the effect is, not an explosion, but that the mixture acquires a property by which in given circumstances it will explode. The ingredients of the gunpowder have been brought into a state of preparedness for exploding as soon as the other conditions of an explosion shall have occurred.'

And he tells us that physiological processes 'often have for the chief part of their operation to predispose the constitution to some mode of action'.

This distinction may profitably be carried further and emphasized in our terminology. Take any thing, or any integrated group of things, regarded as that higher order of thing which we call a self-contained system.

Process occurs therein, and process involves change. In so far as the system is self-contained its changes and states are inherent in its constitution. We need a term by which to designate that which is thus inherent and constitutional. The term *ground* might be reserved for this purpose. The word ground has its natural home in logic. It is here extended (if it be an extension) to that to which the logic has reference in the existing world. One is here following Spencer, who claims[47] that 'Logic is a science pertaining to objective existence'. On these terms the constitution of any system is the ground of the properties, states, and happenings in that system regarded as isolated. But the changes or properties will be also in relation to surrounding things or systems. *These* changes, or modifications of change, in relation to external things or events, may properly be said to be conditioned; and we may well restrict the term conditions to influences *outside* the constitution as ground. Of course, if we accept this usage, we must not speak, with Mill, of the constitution of any system as the condition of its inherent changes or properties. That is why we need some such word and concept as ground. Now we may fix our attention on any constituent part of some natural system and make that part the centre of our interest. That part may be changing in virtue of its constitution; and the rest of the system, regarded as external to this selected part, must therefore be regarded as conditioning. It is a matter of convenience for purposes of scientific interpretation whether we select a larger or a smaller system-group and discuss its constitutional character. Thus we may think of the constitution of the solar system, or of that of the sun's corona; of the constitution of an organism or of that of one of its cells; of the constitution of

a complex molecule or of that of an atom therein. We have here reached, or nearly reached, the limiting case in one direction—that of restricting our field of inquiry. The limiting case in the other direction is, I suppose, the universe. But could we so expand our thought as to embrace, if that were possible, the whole universe, then there are no conditions; for *ex hypothesi* there is nothing for science outside the universe. We have reached the limiting concept. Hence, for science, the constitution of nature is the ultimate ground of all that is or happens.

Let us now see how we stand. Consider the following statements:

1. The Unknowable is the cause of all the phenomena we observe.

2. The constitution of gunpowder is the cause of its explosiveness.[48]

3. The fall of a spark was the cause of the actual explosion of the powder.[49]

Or these:

1. Life is the cause of all vital manifestations.

2. The inherited nature of a hen's egg is the cause of its producing a chick and not a duckling.

3. The cause of the development of the chick embryo is the warmth supplied by the incubating mother.[50]

In each case the reference under (1) is to a transcendent cause which produces the phenomena under consideration. I suggest that the word Source should here be used instead of cause. In each case the reference under (2) is to the nature or constitution of that within which some process occurs. I suggest that the word ground should here be used instead of cause. In each case the reference under (3) is to some external influence. I suggest that the word condition should here be used

instead of cause. We thus eliminate the word cause altogether. But since, in nine cases out of ten, the conditions, or some salient condition, is what is meant by cause in popular speech, and in the less exact sciences, the word cause may perhaps be there retained with this particular meaning. These are of course merely suggestions towards the avoidance of puzzling ambiguity. One could wish that Spencer could have thought out some such distinctions to help his sorely perplexed readers.

One could wish, too, that he had devoted his great powers of thought to a searching discussion of the different types of relatedness which are found in nature, and to a fuller consideration of a synthetic scheme of their inter-relatedness. It is imperative that our thought of relations should have a concrete backing. 'Every act of knowing', says Spencer, 'is the formation of a relation in consciousness answering to a relation in the environment.' But the knowledge-relations are of so very special a type; and the relations in the environment are so many and varied. Much more analysis of natural relations is required than Spencer provides. I do not mean, of course, that there is any lack of analysis—and of very penetrating analysis—in the *Psychology*, the *Biology*, the *Sociology*, and the *Ethics*. I mean that in *First Principles*, which must be regarded as his general survey of the philosophy of science, there is no searching analysis of the salient types of relationship which enter into the texture of this very complex world. Such omnibus words as differentiation, integration, segregation, do duty in various connexions with convenient elasticity of meaning to suit the occasion. But apart from qualifying adjectives,[51] such as astronomic, geologic, and so on up to artistic and literary, there is too

little attempt at either a distinguishing of the types of relatedness or at a relationing of the relations so distinguished. One just jumps from one to another after a break in the text, and finds oneself in a wholly new field of inquiry. Little but the omnibus terminology remains the same. Nor does the *Essay on the Classification of the Sciences*, with all its tabulation, furnish what is really required. What one seeks to know is how those specific kinds of relatedness which characterize the successive phases of evolutionary progress, inorganic, organic, and superorganic, differ from one another and how they are connected. This one does not find. The impression one gets, here and elsewhere, is that all forms of relatedness must somehow, by the omission of all other specific characters, be reduced to the mechanical type. This, no doubt, is unification of a sort. But is it the sort of unification with which a philosophy of science should rest content?

It may be said that unification can only be reached by digging down to some ubiquitous type of relation which is common to all processes throughout the universe at any stage of evolution. But what, on these terms, becomes of evolution itself as a problem to be solved? Surely any solution of that problem must render an account of just those specific modes of relatedness which have been ignored in digging down to the foundations. Surely there must be unification of the superstructure as well as of the substructure. Here and now is our world, within the texture of which things stand to each other in such varied relations, though they may be reducible to a few main types. There, in the faraway part, was the primitive fire-mist, dear to Spencer's imagination, in which the modes of relationship were so few and so simple, and all seemingly of one main

type. How do we get in scientific interpretation from the one to the other? Will it suffice to breathe over the scene the magic words differentiation and integration? Spencer appears to think so. Of course he did exceptionally fine work in elucidating the modes of differentiation and integration within certain relational fields—though he sometimes uses the latter word for mere shrinkage in size.[52] But what one asks, and asks of him in vain, is just how, within a connected scheme, the several relational fields in the domain of nature are themselves related, and how they were themselves differentiated. How, for instance, did the specific relationships exhibited in the fabric of crystals arise out of the primitive fire-mist relations? At some stage of evolution this specific form of relatedness came into being, whereas before that stage was reached it was not in being. No doubt we may say that the properties of the pre-existing molecules were such that these molecules could in due course become thus related, and enter into the latticed architecture of the crystal. They already possessed the potentiality of so doing. And if we have resort to potentialities, all subsequently developed types and modes of relatedness were potentially in existence *ab initio*—they were, as Tyndall said, 'once latent in a fiery cloud.' But it is difficult to see how the specific modes of relatedness which obtain within the crystal, can be said to exist prior to the existence of the crystal within which they so obtain.

Preserving the spirit of Spencer's teaching we must regard all modes of relatedness which are disclosed by scientific research as part and parcel of the constitution of nature, from whatever Source, knowable or unknowable, that constitution be derived. Of these modes there are many; indeed, if we deal with all concrete cases,

their number is legion. For purposes of illustration, however, we may reduce them, rather drastically, to three main types. There are relations of the physico-chemical type,[53] which we may provisionally follow Spencer in regarding as ubiquitous; there are those of the vital type, which are restricted to living organisms; there are those of the cognitive type, which seem to be much more narrowly restricted. How we deal with these is of crucial importance. Denoting them by the letters A, B, C we find that there are progressively ascending modes of relatedness within any given type. There is evolution within each type. Within the physico-chemical type A, for example, atoms, molecules, and synthetic groups of molecules follow in logical order of evolution. Now the successive products, in which this physico-chemical type of relatedness obtains, have certain *new and distinctive properties* which are not merely the algebraic sum of the properties of the component things prior to synthesis. We may speak of them as constitutive of the products in a higher stage of relatedness, thus distinguishing constitutive from additive properties.[54] Similarly when B, the vital relations, are evolved, the living products, in which these specific relations obtain, have new constitutive properties, on the importance of which vitalists are right in insisting, though I emphatically dissent from some of the conclusions they draw from their presence. For if, beyond the physico-chemical, a special agency be invoked to account for the presence of new constitutive properties, then, in the name of logical consistency, let us invoke special agencies to account for the constitutive properties within the physico-chemical—for radio-active properties for example. If a Source of phenomena be postulated, why not postulate One Source of all

phenomena from the very meanest to the very highest? There remains the case of C—the synthetic whole in which cognitive relatedness obtains. This is unquestionably more difficult of scientific interpretation. But I believe that like statements may be made in this case also. What we have, I conceive, is just a new and higher type of relatedness with specific characters of its own. But of this more in the sequel.

It must be remembered that A, B, C stand for *relationships* and that the related things are progressively more complex within more complex relational wholes. Relationships are every whit as real as are the terms they hold in their grasp. I do not say more real; but I say emphatically as real. And if this be so, then they ought somehow to be introduced into our formulae, instead of being taken for granted. We give H_2O as the formula for a molecule of water. But that molecule is something very much more than two atoms of hydrogen + one atom of oxygen. The absolutely distinctive feature of the molecule is the specific relatedness of these atoms. This constitutive mode of relatedness is, however, just taken for granted. And it is scarcely matter for surprise that, when we find not less specific modes of vital relatedness in the living organism, they are too apt to be just ignored!

Revert now to the empirical outcome of scientific research, for as such I regard it, that new constitutive properties emerge when new modes and types of relatedness occur, and when new products are successively formed in evolutional synthesis. This, it will be said, involves the acceptance of what is now commonly called creative evolution. I am far from denying that, in the universe of discourse where Source is under consideration, the adjective is justifiable. But, in the universe of

discourse of science, I regard it as inappropriate. What we have is just plain evolution; and we must simply accept the truth—if, as I conceive, it be a truth—that in all true evolution there is more in the conclusion than is given in the premises; which is only a logical way of saying that there is more in the world to-day than there was in the primitive fire-mist. Not more 'matter and energy', but more varied relationships and new properties, quite unpredictable from what one may perhaps speak of as the fire-mist's point of view. This is no new doctrine, though it has received of late a new emphasis. Mill, dealing with causation,[55] speaks of a 'radical and important distinction'. There are, he says in substance, some cases in which the joint effect of the several causes is the algebraical sum of their separate effects. He speaks of this as the 'composition of causes', and illustrates it from the 'composition of forces' in dynamics 'But in the other description of cases', he says, 'the agencies which are brought together cease entirely, and a totally different set of phenomena arise.' In these cases 'a concurrence of causes takes place which calls into action new laws bearing no analogy to any that we can trace in the separate operation of the causes'. They might, he suggests, be termed 'heteropathic laws'. G. H. Lewes, too,[56] in his *Problems of Life and Mind*, drew the distinction between properties which are *resultant* and those which are *emergent*. These suggestions were open to Spencer's consideration long before the last edition of *First Principles* appeared. They were, however, too foreign to the established lines of his thought to call for serious consideration.

But if new relationships and new properties appear in the course of evolutionary progress, where is the opportunity for that unification of scientific knowledge which,

according to Spencer, is the goal of philosophy? To be frank, I am by no means sure that this question can be answered in a manner that is other than tentative. Perhaps we have not yet reached the stage at which more than provisional unification is possible. Such provisional unification as is suggested by a survey of the facts is that of seemingly uniform correlation in a hierarchy of logical implication. There are certain modes of relatedness which belong to the cognitive type. It would seem that whenever these obtain they may be correlated with other modes of relatedness which are of the vital or physiological type; and that these, in turn, may be correlated with those that are physico-chemical. Thus C implies B, and B implies A. The order cannot be reversed. Physico-chemical relations, *as a class*, do not imply those that are physiological.[57] The implication is not symmetrical. Spencer was within sight of this when he spoke[58] of the abstract-concrete sciences as 'instrumental' with respect to the concrete sciences, though the latter are not 'instrumental' in the same sense with respect to the former. But unfortunately he regarded the 'chasm' between the two groups as 'absolute'. And for him the proper home of properties—of all properties it would appear—is the abstract-concrete group—mechanics, physics, and chemistry. This seemingly leaves no place for a specific type of properties connected with vital relatedness as such. In fact Spencer's method of treatment reduces all modes of relatedness to the A type, the laws of which are, for him, the primary 'causes' of all kinds of differentiation and integration. Hence the laws of biology and psychology can ultimately be expressed and explained, he thinks, in mechanical or mechanistic terms. But in the doctrine of implication they are just the laws of B and C

respectively, though laws of A may underlie them in a logical sense. And as we ascend the evolutionary plane from A to AB and thence to ABC—from the physico-chemical to the vital and thence to the cognitive—we find new modes of relatedness, new forms of more complex integration and synthesis, new properties successively appearing in serial order. This seems to me simply to express, in outline, the net result of interpretation based on empirical observation—though much, very much, requires to be filled in by future research. And the new properties are not merely additive of preceding properties; they are constitutive, and characterize the higher evolutionary products as such. Why they are thus constitutive, science is unable to say. Spencer, of course, calls in the Unknowable to supply the required nexus.[59] Otherwise, in each case, he confesses that 'we can learn nothing more than that here is one of the uniformities in the order of phenomena'.[60] None the less we may be able some day to establish an ordinal correlation[61] of cognitive processes with physiological processes, and an ordinal correlation of these physiological processes with those of the physico-chemical type. That I conceive to be the ideal of strictly scientific interpretation if it is to be raised progressively to a level approaching that of the exact sciences. It certainly is not yet attained. But I see no reason why we should not regard it as attainable. It will involve the very difficult determination of many correlation coefficients and constants—and for some of these our data are, it must be confessed, both scanty and unreliable.

We must here note a much-discussed departure on Spencer's part from his earlier position. On the first page of the *Biology* in the earlier editions, and in the last, we are told:

'The properties of substances, though destroyed to sense by combination are not destroyed in reality. It follows from the persistence of force that the properties of a compound are resultants of the properties of its components, resultants in which the properties of the components are severally in full action, though mutually obscured.'

There is no hint here of Mill's heteropathic laws nor of Lewes's emergents. But in the last edition a special chapter is inserted on the Dynamic Element in Life. We here find a tardy recognition of the presence of specific vital characters.

'The processes which go on in living things are incomprehensible as the results of any physical actions known to us. . . . In brief, then, we are obliged to confess that Life in its essence cannot be conceived in physico-chemical terms.'[62]

I speak of this as a tardy recognition; but it is one that does honour to the man; it is a frank admission that his previous treatment was in some measure inadequate, which a smaller man would not have had the honesty or the strength of character to make. Of course it is traced down to the Unknowable. 'Life as a principle of activity is unknown and unknowable; while phenomena are accessible to thought the implied noumenon is inaccessible.'[63] Still, certain specific characteristics of living organisms are explicitly recognized as among the accessible phenomena; and these cannot be conceived in physico-chemical terms. But did Spencer fully realize how big a hole this knocks in the bottom of the purely mechanical interpretation of nature he had for so long championed?

There remains for consideration the place of the cognitive relation in Spencer's philosophy of science. We need not here discuss his transfigured realism. Apart from the customary references to the Unknow-

able, of which what is knowable is said to be symbolic, it comes to little more than laying special emphasis on the truism that what is known in the so-called objective world involves the process of knowing; from which it follows that, apart from knowing it the objective world cannot be known. From this Spencer draws the conclusion that terms in cognitive relatedness have their very nature determined in and through that relatedness, and cannot *in themselves* be what they are, and as they are, in the field of cognitive symbolism. This may or may not be true. I am one of those who question the validity of the arguments in favour of this conclusion. Since, however, the philosophy of science deals only with the knowable—of which the so-called appearances with which we have direct acquaintance are the primary data—we need not here trouble ourselves with the controversy between realists and symbolists. Even on Spencer's view the world as symbolized *is* the real world *for science.*

Now one way of expressing the fact that the cognitive relation is always present where knowledge is concerned is to proclaim 'the truth that our states of consciousness are the only things we can know'.[64] But it is a terribly ambiguous way of expressing the fact. What is here meant by a state of consciousness? So far as cognition is concerned it is, or at any rate it involves, a relationship between something known and the organism, as knowing—for Spencer assuredly the organism, though a so-called inner aspect therein. Of course it is a very complex relationship. It comprises relations in what is known, and relations in the organism as knowing. Hence Spencer defines life, psychical as well as physical, as 'the continuous adjustment of internal relations to external relations'.[65]

> 'That which distinguishes Psychology is that each of its propositions takes account both of the connected internal phenomena and of the connected external phenomena to which they refer. It is not only the one, nor only the other, that characterises cognition. It is the connexion between these two connexions.' [66]

So far well. Cognition is a very complex network of relatedness involving many terms. What are these terms? For Spencer the internal terms are ultimately nervous (=psychic) shocks in highly integrated aggregates; and the external terms are, proximately at least, things in the environment. But both alike are spoken of as states of consciousness. There is surely an opening for ambiguity here. Sometimes, too, the words subjective affections are used in place of states of consciousness. 'Thus we are brought to the conclusion that what we are conscious of as properties of matter, even down to its weight and resistance, are but subjective affections.' [67] Well, these states of consciousness, these subjective affections, fall into two great classes—the vivid and the faint. The former, which we know as sensations, accompany direct and therefore strong excitations of the nerve-centres; the latter, which we know as remembered sensations, or ideas of sensations, accompany indirect and therefore weak excitations of the same nerve-centres.[68] And then we are told that the aggregate of the faint is what we call the mind, the subject, the *ego*; the aggregate of the vivid is what we call the external world, the object, the *non-ego*.[69] It would seem, then, that the aggregate of vivid *subjective* affections is the *objective* world so far as knowable. To say the least of it, this terminology is somewhat perplexing.

No doubt our knowledge of the external world involves

a subtle and intricate inter-relation of what is experienced vividly and what is experienced faintly—of what is actually presented and what is ideally re-presented. The distinction between them is a valid one. But when Spencer equates this distinction with that between the external world and the mind, as he does in the passages to which I have referred, the validity of his procedure is seriously open to question.

It must be confessed that an adequate analysis of cognitive relatedness on scientific lines is not to be found in Spencer's works. I am not sure that it is yet to be found in the works of any other philosopher, though there are many signs that the difficult problems it involves are receiving serious attention. This much seems certain, for those who accept the spirit, though not perhaps the letter, of Spencer's teaching: that there it is as a constitutive mode of relatedness in the realm of nature, and that, if it forms part of the evolutionary scheme, if it is present in the conclusion, so far reached, though it was absent in the physico-chemical premises, if it is to be included in a philosophy of science it must be dealt with by that philosophy on lines strictly analogous to those on which any other relational problem is treated. Firmly as we may believe in the reality of Source, we must not call to our aid some psychic entity, some entelechy, some *élan vital*, to help us out of our difficulties; for one and all of these lie wholly outside the universe of discourse of science; and not one of them affords the smallest help in solving a single scientific problem in a manner that is itself scientific.

We have seen that Spencer believed that the task of psychology is to investigate the correlation of external and internal relations, and, in that sense, itself to correlate them within a scientific interpretation. Now the out-

come of the former correlation is some form of behaviour or conduct on the part of the organism. No doubt such behaviour affords data to be dealt with in subsequent cognition. But it implies the prior cognition which leads up to it; and it is this prior cognition, abstracted from the behaviour to which it leads, that we have to consider. It is so terribly complex that it is difficult to deal with it comprehensibly in a brief space. Let me, however, try to do so, at least in tentative outline. There occurs, let us say, an external event in the physical world, such as the motion of a billiard-ball across the table; and when during its progress this stimulates the retina, there is an internal physico-chemical process which runs its course in retina, optic nerves, and the central nervous system. We may regard these two processes, external and internal, as *so far*, of like physical order. With adequate knowledge the two could, in some measure, be serially correlated as such. But the physico-chemical processes in the organism are not only of this physical type. They are vital or physiological as well. And this makes a real difference. Of course this statement is open to question. But I, for one, believe that there are specific relations present in physiological processes, *qua* vital, other than those of the physico-chemical type—relations which are effective and which require a distinctive name. So far I am a vitalist. At some stage of evolution these new modes of effective relatedness came into being, whereas in the fire-mist and for long afterwards they were not in being. None the less when they did actually come into being, under conditions of which we are at present ignorant—though not so ignorant as we were—they were dependent upon, and, for our interpretation, they logically imply, the physico-chemical relations which are also present. In any given case they further imply, through

heredity-relatedness, the evolutionary history of the organism in which they obtain. This so-called historical element in biology no doubt involves a characteristic vital relationship. But, I take it, the physico-chemical constitution of any inorganic compound, and of any molecule therein, has also its history—has relationship to past occurrences within its type, which have helped to make it what it is. Still, in the organism the relation to past happenings has a quite distinctive form which we deal with in terms of heredity. See, then, how we stand so far. The internal physiological process implies a long chain of heredity-relationships through which the organism is prepared for its occurrence. It also implies a physico-chemical basis, an underlying [70] physico-chemical process. And this implies as a condition of its occurrence, the external event, the passage of the billiard-ball across the table. In a broad sense we may say that the inner process knows the external event which is a condition of its occurrence. But we have not yet reached cognition of the psychological type.

Before passing on to indicate, in tentative outline, the nature of this higher mode of relatedness, I pause to note two points. The first is that knowing in that extended sense which I have borrowed,[71] is essentially selective in its nature. The physiological process, in the case I have taken, knows only that external event which is directly before the eyes and which is serially correlated with changes in the retinal images through the stimulation of specialized receptors. Of other external events it has no such knowledge. Compare this with the gravitative knowledge—if a yet wider extension of the meaning of the word be permitted—which the earth has of the sun and all the other members of the solar system—nay more, in degrees

perhaps infinitesimal, of all other material bodies in the universe. The motion of the earth in its orbit implies the whole of this vast field of gravitative relatedness. The existing orbital motion at any moment implies, too, the preceding motion which it has, in a sense, inherited from the past. Abolish the rest of the universe at this moment and the earth's motion would cease to be orbital. In virtue of its 'inheritance from the past', it would continue at uniform velocity in one direction. The continuous change of direction and velocity we observe, is a response which implies gravitative knowledge. In a sense, then, the whole solar system is known by the earth as it swings in its orbit.

The second point may be introduced by a question. Granted that we may say, in a very liberal sense, that the earth in its motion has this gravitative knowledge —is such knowledge accompanied by awareness? We do not know. But the point I have in mind is this, that the question itself is vague. Awareness of what? There must be awareness of something; and a definite question should be directed towards the nature of that something. For example: is the earth aware of its own motion? Or is it aware of the solar system? Or is it aware of the relation of the one to the other? If it be said that the second of these is meant when we ask whether the knowledge is accompanied by awareness, well and good. The answer will serve to define the question. Take now a case of biological knowledge. Are the plants in the cottager's window, when they grow towards the light, aware of a process in their own tissues? Or are they aware of the sunshine? Or are they in some measure aware of the connexion between the one and the other? To all these questions we must answer, I suppose, that we do not know. But

it may have been worth while to ask them in a definite way.

We pass, then, to cognition in the usual acceptation of the term—to what we speak of as knowledge in the proper and narrower sense. My contention is that this is a mode of relatedness which science must endeavour to treat on precisely the same lines as it deals with any other natural kind of relatedness. At some stage of evolution it came into being, whereas in the fire-mist, and for long afterwards, it was not in being. None the less when it did come into being, it was dependent on, and for our interpretation it logically implies, underlying physiological processes, as they in turn imply physico-chemical processes, in each case serially correlated. It is pre-eminently selective. And just as any physiological process, however externally conditioned, is grounded in [72] the constitution of the organism, as such, so too is any cognitive process grounded in the constitution of the organism as one in which this higher type of relatedness has supervened. Again, just as the physiological constitution implies a prolonged racial preparation, describable in terms of that mode of relatedness we name heredity, so, too, does any cognitive process imply, not only this racial preparation of the biological kind, but also an individual preparation of the psychological kind—implies relatedness to what we call, rather loosely, prior experience—which itself implies a concurrent physiological preparation.

Now there can be no doubt that awareness is a characteristic feature of the knowledge of cognition, whether it be present or absent in knowledge in the more extended sense. We must just accept this as what appears to be a fact. In science we do not pretend to say why facts are what they are and as they are. We

take them as they are given, and endeavour to trace their connexions and their implications. Accepting, then, awareness as given, we must ask: Awareness of what? It is sometimes said that cognition is aware of itself. I am not sure that I understand what this means. If we are speaking of the cognitive relation, which is an awareness relation, the question seems to be whether a relation of awareness is related to itself. But of course if a field of cognitive relatedness be regarded as a complex whole, any part may be related to the rest, and the rest to any part. That kind of self-awareness—if we must so call it!—is eminently characteristic of cognition in the higher forms of its development. On these terms cognition is aware of itself—though the mode of statement savours of ambiguity.

Let us next ask whether there is awareness of the underlying cortical process. If we are speaking of direct awareness, apparently not. The correlation between the two is only discoverable through a very elaborate and complex [73] application of further cognition in interpretative knowledge. We only know the correlated cortical process by description, as Mr. Bertrand Russell would say, [74] and never by direct acquaintance.

Parenthetic reference must here, I suppose, be made to psycho-physical parallelism. But it shall be very brief. The sooner this cumbrous term with its misleading suggestions is altogether eliminated from the vocabulary of science the better. The locus of the so-called parallelism is, we are told, the cortex of the brain. But the cortical process is only an incident—no doubt a very important one, but still an incident—in a much wider physiological process, the occurrence of which, in what we may speak of as primary cognition, implies events in the external world. It is of these events that there

is direct physical, physiological, and cognitive knowledge. Of course there are also inter-cortical relations which underlie the relations of those ideal cognita (Spencer's faint class) that supplement the primary cognita which imply direct stimulation of sensory receptors (Spencer's vivid class). It is questionable whether any form of cognition, properly so called, is possible in their absence. Now I see no objection to labelling the fact (if it be a fact) that the cognitive process implies a physiological process in which, as in a larger whole, the cortex plays its appropriate part, by the use of some such convenient correlation-word as psycho-physical; but only so long as this does not involve a doctrine of parallelism; so long as it merely means that cognition implies, let us say, certain underlying cortical changes. Of course it implies a great deal more than cortical process only; but this may perhaps be taken for granted. My chief objection to the word 'parallelism' is that it suggests two separate orders of being, and not two types of relationship within one order of being for scientific study.[75] We do not speak of parallelism between physiological and physico-chemical processes. We just say that scientific interpretation proceeds on the working hypothesis that there is a correlation of such a kind that physiological process implies a physico-chemical basis. So too, I urge, we should be content to say that scientific interpretation proceeds on the working hypothesis that there is a correlation of such a kind that cognitive process implies a physiological basis.

It may be said that Spencer accepted the so-called identity hypothesis which does not lie open to the objection that it suggests two orders of being. He believed [76] 'that mind and nervous action are the subjective and objective faces of the same thing', though 'we remain

utterly incapable of seeing or even imagining how the two are related'. Well, we may call them in one passage the same thing, we may speak, in another passage, of the antithesis between them as never to be transcended, and we may try to save the situation by reference to duality of aspect. But this kind of treatment does not help as much towards a scientific interpretation. It is true that, in yet another passage, speaking of the correlation of the physical and the psychical, Spencer says: [77] 'We can learn nothing more than that here is one of the uniformities in the order of phenomena.' Then why not leave it at that? And if there be a constant and uniform correlation which is 'in a certain indirect way quantitive', it would seem that we *do* see, as far as science ever professes to see, 'how the two are related.' We see, or conceive, how they are related in much the same way as we do in the case of the connexion between the physiological and the physico-chemical, and in numberless other cases. Both parallelism and identity will have to go by the board in a philosophy of science. They must be replaced by the far more modest hypothesis, which seems to express all that they really mean for science, that cognition always implies certain physiological processes in the organism.

If we do speak of mind and nervous action as two faces of the same thing, it seems pretty certain that the one face is not directly aware of the other. When we speak of awareness in cognition we must therefore, it appears, exclude any direct awareness of concurrent physiological processes. Of what, then, is there awareness? Primarily perhaps of some occurrence in the external world. But the difficulty here is that, in the simplest case of human cognition there is awareness of so many things and in such varying degrees. There

may be primary awareness of events in the external world (Spencer's vivid series), awareness of the relations involved in these occurrences as such, of the relations of these to ideal re-presentations of like kind (Spencer's faint series), of the relations of any or all of these to behaviour as actually taking place or as ideally re-presented; and all in different degrees within a relational meshwork of bewildering complexity, which we have not, as yet, adequately unravelled. The essential point to bear in mind is that the cognitive relation always involves relatedness of *many terms*, and that its discussion involves the analysis of what, in the higher phases of its existence, is probably the most complex natural occurrence in this complex world.

I cannot here follow up further the difficult problem of cognition [78]—save to add one or two supplementary remarks. First: it is, I suppose, fairly obvious that any given field of cognitive relatedness comprises *all* that is then and there selectively cognized. Just as, in the very extended sense of the word 'knowledge', the earth knows, in gravitative fashion, the whole solar system, as does also any one of the planets, so, in the restricted sense, is knowledge co-extensive with all that is, selectively, in cognitive relationship with the organism or that part of the organism which is the locus of awareness. I speak here of the locus of awareness in just the same sense as I might speak of the earth as a locus of gravitative knowledge of the solar system. The locus of awareness is just a specialized portion of the whole relational web. In other words, the relatedness is of the part-whole kind, where whole means rest of the whole other than the specific part. In any such integrated system the part implies the whole—which, by the way, is quite a different matter from saying that

the part includes the whole, or, as I understand the words, is equivalent to the whole. But, whereas gravitative knowledge is reciprocal—the sun knowing the earth in the same fashion as the earth knows the sun—cognitive knowledge is not reciprocal. My cognitive awareness of a spinning-top does not imply that the spinning-top is in like manner aware of me. The part knows the whole in a way that the whole does not know the part. The relationship of the part to the rest of the whole is not reciprocal or symmetrical. This we must just accept as a given feature of cognitive relatedness.[79]

Another very important point is that cognitive relatedness is effective. By this I mean that just as, when the earth is in gravitative relation to the sun and the other planets (the constitution of nature being what it is), changes take place because the parts of the system as a whole are in this field of effective relatedness; so too, when the organism is in cognitive relation to its environment, changes in this system also take place just because a part of the whole system is in cognitive relatedness to the rest of the system. That means that the cognitive relation really counts—that it is not merely an epiphenomenal accompaniment of changes which would be precisely the same if it were absent. The 'sum of energy' presumably remains constant. There is no necessary interference with physical principles. But we know of so many cases in which the direction of change may be changed without any alteration of the 'amount of energy', as the phrase goes, that I see no reason, based on physical science,[80] for denying this kind of effectiveness, within a field of cognitive relatedness, if the facts seem indubitably to point to its existence. To assert that the presence or absence of

cognitive relatedness makes absolutely no difference appears to me, I confess, little short of preposterous; to urge that it may be brought under the rubric of physico-chemical relatedness surely involves the ignoring of differentiating features, which science should not ignore. But, on the other hand, to invoke an immaterial psychic entity[81]—unless this merely names the relatedness itself[82] as gravitation names the gravitative relatedness—appears to me quite unwarranted in the scientific universe of discourse.[83]

I must, however, draw to a conclusion. I cannot but think that Spencer failed to bring cognition and the conscious awareness it involves into really close touch with the rest of his philosophy of science. No such double-aspect theory as he accepted affords a satisfactory avenue of scientific approach. But where Spencer failed, who has come within measurable sight of success? We are only just beginning to see our way to stating the problem in such a form as to bring it within the purview of science. What we must insist on, as followers, at a distance, of Herbert Spencer, is the treatment of this type of relatedness on lines similar to our treatment of other types of relatedness within one order of nature.

Surveying his work as a whole, we may confidently assert that Spencer brought to a conclusion a great task, and was himself great in its execution. The present generation can, perhaps, hardly realize how potent his influence was on the thought of the latter half of the last century. Many of his conclusions ran counter to those which were, in his day, widely accepted. If only they seemed to him to be true, however, he held to them with a tenacity which his opponents branded as obstinacy. But as he himself said:

'It is not for nothing that a man has in him sympathies with some principles and repugnance to others. He, with all his capacities, and aspirations, and beliefs, is not an accident but a product of his time. While he is a descendant of the past he is a parent of the future; and his thoughts are as children born to him, which he may not carelessly let die. Not as adventitious therefore will the wise man regard the faith that is in him. The highest truth he sees he will fearlessly utter; knowing that, let what may come of it, he is thus playing his right part in the world.'[84]

NOTES

[1] *Fragments of Science*, vol. ii, p. 132.

[2] *Essays*, vol. i (American reprint), p. 3.

[3] *Op. cit.*, p. 32. [4] *Op. cit.*, p. 58.

[5] Cf. W. K. Clifford, *Lectures and Essays*, vol. i, p. 95.

[6] *More Letters*, vol. ii, p. 235.

[7] *Memories and Studies*, p. 139. [8] *Ibid.*, p. 140.

[9] *Autobiography*, vol. i, p. 212. [10] James, *op. cit.*, p. 124.

[11] *Autobiography*, vol. i, p. 211.

[12] *First Principles*, Sixth (Popular) Edition, p. 446 (hereafter F. P.).

[13] *Principles of Psychology*, Third Edition, vol. i, p. 508 (hereafter Ps.).

[14] Ps., vol. i, p. 627. [15] *Ibid.*, p. 158.

[16] F. P., p. 155. [17] Ps., vol. ii, p. 484.

[18] There is '*intrinsic* force by which a body manifests itself as occupying space, and that *extrinsic* force distinguished as energy'. F. P., p. 150.

[19] 'Divest the conceived unit of matter of the objective correlate to our subjective sense of effort and the entire fabric of physical conceptions disappears.' F. P., p. 151 note. Cf. Ps., vol. ii, pp. 237, 239.

[20] F. P., p. 171.

[21] e. g. 'Social changes take directions that are due to the joint actions of citizens determined as are those of all other changes wrought by the composition of forces.' 'The flow of capital into business yielding the largest returns, the buying in the cheapest market and selling in the dearest, the introduction of more economical modes of manufacture, the development of better agencies for distribution, exhibit movements taking place in directions where they are met by the smallest totals of opposing forces.' F. P., pp. 193-6.

[22] *Creative Evolution*, English translation, p. 53.

[23] *Op. cit.*, pp. 385, 6.

[24] According to Dr. Carr's interpretation of M. Bergson, 'The whole world, as it is presented to us and thought of by us, is an illusion. Our science is not unreal, but it is a transformed reality. The illusions may be useful, may, indeed, be necessary and indispensable, but nevertheless it is illusion.' *Problem of Truth*, p. 66.

[25] *Creative Evolution*, p. 389.

[26] 'But, when I posit the facts with the shape they have for me to-day, I suppose my faculties of perception and intellection such as they are in me to-day; for it is they that portion the real into lots, they that cut the facts out of the whole of reality.' C. E., p. 389.

[27] *Creative Evolution*, p. 389. [28] *Op. cit.*, p. 387.

[29] *Introduction to Metaphysics*, English translation, p. 8 and *passim*.

[30] e.g. 'Organisation can only be studied scientifically if the organised body has first been likened to a machine.' C. E., p. 98. Science is, I think, generally used by M. Bergson for *intellectual* knowledge in contradistinction to intuitional knowledge.

[31] F. P., p. 184. [32] *Essays*, vol. iii, p. 14.

[33] *Essays*, vol. iii, p. 366. [34] F. P., p. 156.

[35] 'There remained to assign a reason for that increasingly-distinct demarkation of parts, &c.... This reason we discovered to be the segregation, &c.... This cause of the definiteness of local integrations, &c.' F. P., p. 440.

[36] F. P., p. 43. [37] *Essays*, vol. iii, p. 47.

[38] F. P., p. 176. [39] F. P., p. 154.

[40] *Proceedings Aristotelian Society*, 1912–13, p. 1.

[41] *Popular Scientific Lectures*, English translation, p. 254.

[42] *Lectures and Essays*, vol. i, p. 111.

[43] 'But when we ask what this energy is, there is no answer save that it is the noumenal cause implied by the phenomenal effect.' F. P., p. 154. It is towards this and like statements that my criticism is directed. There can be no objection to the treatment, by physicists, of energy as an entity in the sense given below in note 82. Those phenomena to which $\frac{1}{2}mv^2$ has reference are fundamental realities for physical science.

[44] In a statement of the law of gravitation we may substitute the words 'in a degree' for 'with a force'; we may speak of 'the measure of attraction' instead of 'the force of attraction'.

[45] *System of Logic*, Bk. III, ch. v, § 3, Eighth Edition, vol. i, p. 383.

[46] *Ibid.*, § 3 and § 5, pp. 379 and 389.

[47] Ps., vol. ii, p. 93; cf. p. 97. One has now, however, to add the realm of subsistence.

[48] As a more technical example the following may be given:—The difference in properties of isomers is caused by difference of internal molecular structure notwithstanding identity of chemical composition.

[49] If we take spark as cause and explosion as effect there is

obviously no proportionality between the cause and its effect. Thus M. Bergson speaks of the spark as 'a cause that acts by releasing'; and he adds that 'neither quality nor quantity of effect varies with quality or quantity of the cause: the effect is invariable'. *Creative Evolution*, p. 77. Compare what Spencer introduced into the Sixth edition of F. P. (pp. 172–3), concerning 'trigger action which does not produce the power but liberates it'. According to the treatment in the text there can be no 'proportionality' unless both ground and conditions are taken into account.

[50] Spencer says (F. P., pp. 169–70) that 'the transformation of the unorganised contents of an egg into the organised chick is a question of heat' ['altogether a question of heat', in the Third Edition], and tells us that 'the germination of plants presents like relations of cause and effect as every season shows'. But he also says that 'the proclivities of the molecules determine the typical structure assumed'. Obviously here the 'heat supplied' falls under (3) of the text, and 'the proclivities of the molecules' is his notion of what should fall under (2).

[51] See Index to F. P., *sub verbo* 'integration'.

[52] e.g. 'Diminish the velocities of the planets and their orbits will lessen—the solar system will contract, or become more integrated.' *Essays*, vol. iii, p. 28. Mere condensation is often spoken of as integration. But then the term is used with bewildering laxity. Cf. James, *Memories and Studies*, p. 134.

[53] I retain in this connexion the current term physico-chemical. It seems that the basal type of relatedness here is electrical. It may be said that when we come down to the atom the *things in* relation are electrical, are electrons, are positive and negative charges. So be it. But is it not the *electrical relatedness* that is constitutive of the atom as such?

[54] 'A large number of physical properties', says Nernst, 'have been shown to be clearly additive; that is, the value of the property in question can be calculated as though the compound were such a mixture of its elements that they experience no change in their properties.' But other properties are not additive. 'The kind of influence of the atom in a compound is primarily dependent on the mode of its union, that is, upon the constitution and configuration of the compound. Such non-additive properties may be called constitutive.' Quoted by E. G. Spaulding in *The New Realism*, p. 238.

[55] *System of Logic*, vol. i, Bk. III, ch. vi.

[56] *Problems of Life and Mind*, Series II, p. 212.

[57] Of course if a particular physico-chemical change (*a*) is corre-

lated with a particular physiological or vital change (*b*), then (*b*) implies (*a*) as (*a*) implies (*b*). The statement in the text refers to the implications of classes of change. There may be physico-chemical relatedness without any correlated vital relatedness; but there does not appear to be any vital relatedness which is not correlated with physico-chemical relatedness.

[58] *Essays*, vol. iii, pp. 31, 55.

[59] Ps., vol. ii, p. 484. [60] F. P., p. 178.

[61] An ordinal correlation is one that couples every term of a series (*a*) with a specific term of another series (*b*) and *vice versa* in the same order in each. Cf. Spaulding in *The New Realism*, p. 175. I shall sometimes speak of such correlation as serial.

[62] *Principles of Biology*, Edition of 1898, pp. 117, 120.

[63] *Op. cit.*, p. 122. [64] Ps., vol. i, p. 208.

[65] F. P., p. 61. Cf. Ps., vol. i, p. 134.

[66] Ps., vol. i, p. 132. James well says 'Spencer broke new ground here in insisting that, since mind and its environment have evolved together, they must be studied together. He gave to the study of mind in isolation a definite quietus, and that certainly is a great thing to have achieved'. *Memories and Studies*, p. 140.

[67] Ps., vol. i, p. 206. [68] Ps., vol. i, p. 124.

[69] F. P., p. 120. Ps., vol. ii, p. 472. Cf. Ps., vol. i, p. 98.

[70] The word underlying is used in the sense of occupying a lower position in the logical hierarchy above indicated. If any one likes to speak of the physico-chemical and the vital as two aspects of one process, he is free to do so. And if he likes to say that the vital is caused by the physico-chemical, let him do so; but he must define the exact sense in which he uses the ambiguous word cause. The word inner in the text means within the organism.

[71] See S. Alexander, 'On Relations: and in particular the Cognitive Relation.' *Mind.*, vol. xxi, N.S., No. 83, p. 318.

[72] I have avoided the use of the word determine. It would be well to distinguish between that which is *determined* from without, that is, conditioned, and that which is *determinate*, that is, grounded in the constitution. I am here, I think, in line with Bosanquet. (See *Principle of Individuality and Value*, e. g. pp. 341, 352.) I have also avoided all reference to teleology. Without committing myself to the acceptance of all that Mr. Bosanquet says in the fourth lecture of the series to which reference has just been made, his treatment, there, appears to be on right lines. There is no opposition in teleology, so treated, to what is determinate. Indeed, such teleology is the expression of the logical structure of the world, or, as Spencer would say, the universality of law. For just as higher

types of relatedness imply a substratum of physico-chemical processes, so do all events imply the underlying logic of events. Cf. W. T. Marvin, *A First Book of Metaphysics*, ch. xiii, 'On the logical strata of reality.'

[73] Cf. Ps., vol. i, pp. 99 and 140.

[74] *Problems of Philosophy*, ch. v; cf. *Proc. Aristotelian Soc.*, 1910–11, p. 108.

[75] It should be distinctly understood that I here speak of one order of being in reference to the phenomena dealt with by science, including the cognitive phenomena discussed in the text. Whether we should speak of the Source of phenomena as constituting a separate order of being is a question I cannot discuss in a note. Does the logic of events imply a Logos? That is the question in brief. But, since the implication in question is not of the scientific kind, I may leave it on one side in considering a philosophy of science.

[76] Ps., vol. i, p. 140. [77] F. P., p. 178.

[78] I have confined my attention to the cognitive type of relatedness. Other higher modes supervene when the course of evolution is traced further upwards. Indeed, cognition is only part of the underlying basis implied by the richer forms of distinctively human relational life. Spencer has much to say of them in his *Sociology* and his *Ethics*, though he fails to realize that the phenomena he is dealing with involve essentially new constitutive features in man and in society. Can music or any form of art be discussed in terms of cognition only? I merely add this note to show that I am not unaware of the patent fact that when we have reached the cognitive type of relatedness, we are nowhere near the top of the evolutional tree.

[79] The part which is the centre of awareness, may be spoken of as experienc*ing*, in contradistinction to what is experienc*ed*. It is clear that such experiencing is always correlative to what is experienced actually or ideally (Spencer's vividly or faintly). The centre of awareness is either the cortex, or some specific part of the cortex, or (more generally) the organism as owning the cortex, in each case in accordance with the universe of discourse.

[80] Few physicists would, I think, be prepared to deny that, within a field of effective relatedness, there may be, and very often is, guidance without work done or any change in the 'amount of energy'. What physicists are concerned to insist on is their cardinal principle that every physical change involves physical terms in physical relatedness. This can be fully and freely accepted in accordance with the doctrine of implication sketched in the text.

It is when Life or Consciousness is invoked to play the part of a non-physical term, or thing, which acts and reacts as if it were a physical term or thing, that physicists enter an emphatic protest. Cognitive relatedness among physical things may well be effective in guidance. To claim its presence must not, however, be regarded as in any sense equivalent to a denial of underlying physico-chemical relatedness.

[81] Until those who seek to furnish evidence of the existence of discarnate spirits can make some plausible suggestions as to the nature of a comprehensible scheme of correlation which shall serve to link the discarnate with the incarnate, one is forced to enter their results in a suspense account. It is of little use to proclaim the existence of 'facts scorned by orthodox science'. The so-called facts must be incorporated within a consistent scheme, before they can claim a place in the fabric of scientific truth.

[82] As the word entity is now often used, for example by Mr. G. E. Moore, cognitive relatedness may be termed an entity. 'When I speak of an entity I shall mean to imply absolutely nothing more with regard to that which I so call, than that it *is* or *was*—that it is or was contained in the Universe; and of anything whatever which *is* or *was*, I shall take the liberty to say that it is an entity.' G. E. Moore, *Proc. Aristotelian Soc.*, 1909–10, p. 36.

[83] I have no space to discuss the physiological differentiation which is implied by the effectiveness of the cognitive relation. It involves, I believe, the differentiation of a superior cortical system from an inferior system of nervous arcs. I have dealt with it in some detail elsewhere. See *Instinct and Experience.*

[84] F. P., pp. 91-2.

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SCIENTIFIC METHOD IN PHILOSOPHY

THE HERBERT SPENCER LECTURE

DELIVERED AT THE MUSEUM

18 NOVEMBER, 1914

BY

THE HON. BERTRAND RUSSELL, F.R.S.

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ON SCIENTIFIC METHOD IN PHILOSOPHY

When we try to ascertain the motives which have led men to the investigation of philosophical questions, we find that, broadly speaking, they can be divided into two groups, often antagonistic, and leading to very divergent systems. These two groups of motives are, on the one hand, those derived from religion and ethics, and, on the other hand, those derived from science. Plato, Spinoza, and Hegel may be taken as typical of the philosophers whose interests are mainly religious and ethical, while Leibniz, Locke, and Hume may be taken as representatives of the scientific wing. In Aristotle, Descartes, Berkeley, and Kant we find both groups of motives strongly present.

Herbert Spencer, in whose honour we are assembled to-day, would naturally be classed among scientific philosophers: it was mainly from science that he drew his data, his formulation of problems, and his conception of method. But his strong religious sense is obvious in much of his writing, and his ethical preoccupations are what make him value the conception of evolution—that conception in which, as a whole generation has believed, science and morals are to be united in fruitful and indissoluble marriage.

It is my belief that the ethical and religious motives, in spite of the splendidly imaginative systems to which they have given rise, have been on the whole a hindrance

to the progress of philosophy, and ought now to be consciously thrust aside by those who wish to discover philosophical truth. Science, originally, was entangled in similar motives, and was thereby hindered in its advances. It is, I maintain, from science, rather than from ethics and religion, that philosophy should draw its inspiration.

But there are two different ways in which a philosophy may seek to base itself upon science. It may emphasize the most general *results* of science, and seek to give even greater generality and unity to these results. Or it may study the *methods* of science, and seek to apply these methods, with the necessary adaptations, to its own peculiar province. Much philosophy inspired by science has gone astray through preoccupation with the *results* momentarily supposed to have been achieved. It is not results, but *methods*, that can be transferred with profit from the sphere of the special sciences to the sphere of philosophy. What I wish to bring to your notice is the possibility and importance of applying to philosophical problems certain broad principles of method which have been found successful in the study of scientific questions.

The opposition between a philosophy guided by scientific method and a philosophy dominated by religious and ethical ideas may be illustrated by two notions which are very prevalent in the works of philosophers, namely the notion of *the universe*, and the notion of *good and evil*. A philosopher is expected to tell us something about the nature of the universe as a whole, and to give grounds for either optimism or pessimism. Both these expectations seem to me mistaken. I believe the conception of 'the universe' to be, as its etymology indicates, a mere relic of pre-

Copernican astronomy; and I believe the question of optimism and pessimism to be one which the philosopher will regard as outside his scope, except, possibly, to the extent of maintaining that it is insoluble.

In the days before Copernicus, the conception of the 'universe' was defensible on scientific grounds: the diurnal revolution of the heavenly bodies bound them together as all parts of one system, of which the earth was the centre. Round this apparent scientific fact, many human desires rallied: the wish to believe Man important in the scheme of things, the theoretical desire for a comprehensive understanding of the Whole, the hope that the course of nature might be guided by some sympathy with our wishes. In this way, an ethically inspired system of metaphysics grew up, whose anthropocentrism was apparently warranted by the geocentrism of astronomy. When Copernicus swept away the astronomical basis of this system of thought, it had grown so familiar, and had associated itself so intimately with men's aspirations, that it survived with scarcely diminished force—survived even Kant's 'Copernican revolution', and is still now the unconscious premiss of most metaphysical systems.

The oneness of the world is an almost undiscussed postulate of most metaphysics. 'Reality is not merely one and self-consistent, but is a system of reciprocally determinate parts'[1]—such a statement would pass almost unnoticed as a mere truism. Yet I believe that it embodies a failure to effect thoroughly the 'Copernican revolution', and that the apparent oneness of the world is merely the oneness of what is seen by a single spectator or apprehended by a single mind. The Critical Philosophy, although it intended to emphasize

[1] Bosanquet, *Logic*, ii, p. 211.

the subjective element in many apparent characteristics of the world, yet, by regarding the world in itself as unknowable, so concentrated attention upon the subjective representation that its subjectivity was soon forgotten. Having recognized the categories as the work of the mind, it was paralysed by its own recognition, and abandoned in despair the attempt to undo the work of subjective falsification. In part, no doubt, its despair was well founded, but not, I think, in any absolute or ultimate sense. Still less was it a ground for rejoicing, or for supposing that the nescience to which it ought to have given rise could be legitimately exchanged for a metaphysical dogmatism.

I.

As regards our present question, namely, the question of the unity of the world, the right method, as I think, has been indicated by William James.[1] "Let us now turn our backs upon ineffable or unintelligible ways of accounting for the world's oneness, and inquire whether, instead of being a principle, the 'oneness' affirmed may not merely be a name like 'substance', descriptive of the fact that certain *specific and verifiable connections* are found among the parts of the experiential flux. . . . We can easily conceive of things that shall have no connection whatever with each other. We may assume them to inhabit different times and spaces, as the dreams of different persons do even now. They may be so unlike and incommensurable, and so inert towards one another, as never to jostle or interfere. Even now there may actually be whole universes so disparate from ours that we who know ours have no means of perceiving that they exist. We

[1] *Some Problems of Philosophy*, p. 124.

conceive their diversity, however; and by that fact the whole lot of them form what is known in logic as 'a universe of discourse'. To form a universe of discourse argues, as this example shows, no further kind of connexion. The importance attached by certain monistic writers to the fact that any chaos may become a universe by being merely named, is to me incomprehensible." We are thus left with two kinds of unity in the experienced world; the one what we may call the epistemological unity due merely to the fact that my experienced world is what *one* experience selects from the sum total of existence; the other that tentative and partial unity exhibited in the prevalence of scientific laws in those portions of the world which science has hitherto mastered. Now a generalization based upon either of these kinds of unity would be fallacious. That the things which we experience have the common property of being experienced by us is a truism from which obviously nothing of importance can be deducible: it is obviously fallacious to draw from the fact that whatever we experience is experienced the conclusion that therefore everything must be experienced. The generalization of the second kind of unity, namely, that derived from scientific laws, would be equally fallacious, though the fallacy is a trifle less elementary. In order to explain it let us consider for a moment what is called the reign of law. People often speak as though it were a remarkable fact that the physical world is subject to invariable laws. In fact, however, it is not easy to see how such a world could fail to obey general laws. Taking any arbitrary set of points in space, there is a function of the time corresponding to these points, i.e. expressing the motion of a particle which traverses these points: this function may be regarded as a general law to which the behaviour

of such a particle is subject. Taking all such functions for all the particles in the universe, there will be theoretically some one formula embracing them all, and this formula may be regarded as the single and supreme law of the spatio-temporal world. Thus what is surprising in physics is not the existence of general laws, but their extreme simplicity. It is not the uniformity of nature that should surprise us, for, by sufficient analytic ingenuity, any conceivable course of nature might be shown to exhibit uniformity. What should surprise us is the fact that the uniformity is simple enough for us to be able to discover it. But it is just this characteristic of simplicity in the laws of nature hitherto discovered which it would be fallacious to generalize, for it is obvious that simplicity has been a part cause of their discovery, and can, therefore, give no ground for the supposition that other undiscovered laws are equally simple.

The fallacies to which these two kinds of unity have given rise suggest a caution as regards all use in philosophy of general *results* that science is supposed to have achieved. In the first place, in generalizing these results beyond past experience, it is necessary to examine very carefully whether there is not some reason making it more probable that these results should hold of all that has been experienced than that they should hold of things universally. The sum total of what is experienced by mankind is a selection from the sum total of what exists, and any general character exhibited by this selection may be due to the manner of selecting rather than to the general character of that from which experience selects. In the second place, the most general results of science are the least certain and the most liable to be upset by subsequent research. In utilizing these results as the basis of a philosophy, we

sacrifice the most valuable and remarkable characteristic of scientific method, namely, that, although almost everything in science is found sooner or later to require some correction, yet this correction is almost always such as to leave untouched, or only slightly modified, the greater part of the results which have been deduced from the premiss subsequently discovered to be faulty. The prudent man of science acquires a certain instinct as to the kind of uses which may be made of present scientific beliefs without incurring the danger of complete and utter refutation from the modifications likely to be introduced by subsequent discoveries. Unfortunately the use of scientific generalizations of a sweeping kind as the basis of philosophy is just that kind of use which an instinct of scientific caution would avoid, since, as a rule, it would only lead to true results if the generalization upon which it is based stood in *no* need of correction.

We may illustrate these general considerations by means of two examples, namely, the conservation of energy and the principle of evolution.

(1) Let us begin with the conservation of energy, or, as Herbert Spencer used to call it, the persistence of force. He says: [1]

> 'Before taking a first step in the rational interpretation of phenomena, it is needful to recognize, not only the facts that Matter is indestructible and Motion continuous, but also the fact that Force persists. An attempt to ascertain the laws to which manifestations in general and in detail conform, would be absurd if the agency to which they are due could either come into existence or cease to exist. The succession of phenomena would in such case be altogether arbitrary; and Science, equally with Philosophy, would be impossible.'

[1] *First Principles,* Part II, beginning of chap. vi.

This paragraph illustrates the kind of way in which the philosopher is tempted to give an air of absoluteness and necessity to empirical generalizations, of which only the approximate truth in the regions hitherto investigated can be guaranteed by the unaided methods of science. It is very often said that the persistence of something or other is a necessary presupposition of all scientific investigation, and this presupposition is then thought to be exemplified in some quantity which physics declares to be constant. There are here, as it seems to me, three distinct errors. First, the detailed scientific investigation of nature does not *presuppose* any such general laws as its results are found to verify. Apart from particular observations, science need presuppose nothing except the general principles of logic, and these principles are not laws of nature, for they are merely hypothetical, and applied not only to the actual world but to whatever is *possible.* The second error consists in the identification of a constant quantity with a persistent entity. Energy is a certain function of a physical system, but is not a thing or substance persisting throughout the changes of the system. The same is true of mass, in spite of the fact that mass has often been defined as *quantity of matter.* The whole conception, of quantity, involving, as it does, numerical measurement based largely upon conventions, is far more artificial, far more an embodiment of mathematical convenience, than is commonly believed by those who philosophize on physics. Thus even if (which I cannot for a moment admit) the persistence of some entity were among the necessary postulates of science, it would be a sheer error to infer from this the constancy of any physical quantity, or the *a priori* necessity of any such constancy which may be empirically discovered. In

the third place, it has become more and more evident with the progress of physics that large generalizations, such as the conservation of energy or mass, are far from certain and are very likely only approximate. Mass, which used to be regarded as the most indubitable of physical quantities, is now very generally believed to vary according to velocity, and to be, in fact, a vector quantity which at a given moment is different in different directions. The detailed conclusions deduced from the supposed constancy of mass for such motions as used to be studied in physics will remain very nearly exact, and, therefore, over the field of the older investigations very little modification of the older results is required. But as soon as such a principle as the conservation of mass or of energy is erected into a universal *a priori* law, the slightest failure in absolute exactness is fatal, and the whole philosophic structure raised upon this foundation is necessarily ruined. The prudent philosopher, therefore, though he may with advantage study the methods of physics, will be very chary of basing anything upon what happen at the moment to be the most general results apparently obtained by those methods.

(2) The philosophy of evolution, which was to be our second example, illustrates the same tendency to hasty generalization, and also another sort, namely, the undue preoccupation with ethical notions. There are two kinds of evolutionist philosophy, of which both Hegel and Spencer represent the older and less radical kind, while Pragmatism and Bergson represent the more modern and revolutionary variety. But both these sorts of evolutionism have in common the emphasis on *progress*, that is, upon a continual change from the worse to the better or from the simpler to the more complex. It

would be unfair to attribute to Hegel any scientific motive or foundation, but all the other evolutionists, including Hegel's modern disciples, have derived their impetus very largely from the history of biological development. To a philosophy which derives a law of universal progress from this history there are two objections. First, that the history itself is concerned with a very small selection of facts confined to an infinitesimal fragment of space and time, and even on scientific grounds probably not an average sample of events in the world at large. For we know that decay as well as growth is a normal occurrence in the world. An extra-terrestrial philosopher, who had watched a single youth up to the age of twenty-one and had never come across any other human being, might conclude that it is the nature of human beings to grow continually taller and wiser in an indefinite progress towards perfection; and this generalization would be just as well founded as the generalization which evolutionists base upon the previous history of this planet. Apart, however, from this scientific objection to evolutionism, there is another, derived from the undue admixture of ethical notions in the very idea of progress from which evolutionism derives its charm. Organic life, we are told, has developed gradually from the protozoon to the philosopher, and this development, we are assured, is indubitably an advance. Unfortunately it is the philosopher, not the protozoon, who gives us this assurance, and we can have no security that the impartial outsider would agree with the philosopher's self-complacent assumption. This point has been illustrated by the philosopher Chuang Tzŭ in the following instructive anecdote:

'The Grand Augur, in his ceremonial robes,

approached the shambles and thus addressed the pigs: "How can you object to die? I shall fatten you for three months. I shall discipline myself for ten days and fast for three. I shall strew fine grass, and place you bodily upon a carved sacrificial dish. Does not this satisfy you?"

Then, speaking from the pigs' point of view, he continued: "It is better, perhaps, after all, to live on bran and escape the shambles. . . ."

"But then," added he, speaking from his own point of view, "to enjoy honour when alive one would readily die on a war-shield or in the headsman's basket."

So he rejected the pigs' point of view and adopted his own point of view. In what sense, then, was he different from the pigs?'

I much fear that the evolutionists too often resemble the Grand Augur and the pigs.

The ethical element which has been prominent in many of the most famous systems of philosophy is, in my opinion, one of the most serious obstacles to the victory of scientific method in the investigation of philosophical questions. Human ethical notions, as Chuang Tzŭ perceived, are essentially anthropocentric, and involve, when used in metaphysics, an attempt, however veiled, to legislate for the universe on the basis of the present desires of men. In this way they interfere with that receptivity to fact which is the essence of the scientific attitude towards the world. To regard ethical notions as a key to the understanding of the world is essentially pre-Copernican. It is to make man, with the hopes and ideals which he happens to have at the present moment, the centre of the universe and the interpreter of its supposed aims and purposes. Ethical metaphysics is fundamentally an attempt, however disguised, to give legislative force to our own wishes. This may, of course, be questioned, but I think that it is confirmed by a consideration of the way in which ethical notions arise.

Ethics is essentially a product of the gregarious instinct, that is to say, of the instinct to co-operate with those who are to form our own group against those who belong to other groups. Those who belong to our own group are good; those who belong to hostile groups are wicked. The ends which are pursued by our own group are desirable ends, the ends pursued by hostile groups are nefarious. The subjectivity of this situation is not apparent to the gregarious animal, which feels that the general principles of justice are on the side of its own herd. When the animal has arrived at the dignity of the metaphysician, it invents ethics as the embodiment of its belief in the justice of its own herd. So the Grand Augur invokes ethics as the justification of Augurs in their conflicts with pigs. But, it may be said, this view of ethics takes no account of such truly ethical notions as that of self-sacrifice. This, however, would be a mistake. The success of gregarious animals in the struggle for existence depends upon co-operation within the herd, and co-operation requires sacrifice, to some extent, of what would otherwise be the interest of the individual. Hence arises a conflict of desires and instincts, since both self-preservation and the preservation of the herd are biological ends to the individual. Ethics is in origin the art of recommending to others the sacrifices required for co-operation with oneself. Hence, by reflexion, it comes, through the operation of social justice, to recommend sacrifices by oneself, but all ethics, however refined, remains more or less subjective. Even vegetarians do not hesitate, for example, to save the life of a man in a fever, although in doing so they destroy the lives of many millions of microbes. The view of the world taken by the philosophy derived from ethical notions is thus never impartial and

therefore never fully scientific. As compared with science, it fails to achieve the imaginative liberation from self which is necessary to such understanding of the world as man can hope to achieve, and the philosophy which it inspires is always more or less parochial, more or less infected with the prejudices of a time and a place.

I do not deny the importance or value, within its own sphere, of the kind of philosophy which is inspired by ethical notions. The ethical work of Spinoza, for example, appears to me of the very highest significance, but what is valuable in such work is not any metaphysical theory as to the nature of the world to which it may give rise, nor indeed anything which can be proved or disproved by argument. What is valuable is the indication of some new way of feeling towards life and the world, some way of feeling by which our own existence can acquire more of the characteristics which we must deeply desire. The value of such work, however immeasurable it is, belongs with practice and not with theory. Such theoretic importance as it may possess is only in relation to human nature, not in relation to the world at large. The scientific philosophy, therefore, which aims only at understanding the world and not directly at any other improvement of human life, cannot take account of ethical notions without being turned aside from that submission to fact which is the essence of the scientific temper.

II.

If the notion of the universe and the notion of good and evil are extruded from scientific philosophy, it may be asked what specific problems remain for the philosopher as opposed to the man of science? It would be difficult to give a precise answer to this question, but

certain characteristics may be noted as distinguishing the province of philosophy from that of the special sciences.

In the first place a philosophical proposition must be general. It must not deal specially with things on the surface of the earth, or with the solar system, or with any other portion of space and time. It is this need of generality which has led to the belief that philosophy deals with the universe as a whole. I do not believe that this belief is justified, but I do believe that a philosophical proposition must be applicable to everything that exists or may exist. It might be supposed that this admission would be scarcely distinguishable from the view which I wish to reject. This, however, would be an error, and an important one. The traditional view would make the universe itself the subject of various predicates which could not be applied to any particular thing in the universe, and the ascription of such peculiar predicates to the universe would be the special business of philosophy. I maintain, on the contrary, that there are no propositions of which the 'universe' is the subject; in other words, that there is no such thing as the 'universe'. What I do maintain is that there are general propositions which may be asserted of each individual thing, such as the propositions of logic. This does not involve that all the things there are form a whole which could be regarded as another thing and be made the subject of predicates. It involves only the assertion that there are properties which belong to each separate thing, not that there are properties belonging to the whole of things collectively. The philosophy which I wish to advocate may be called logical atomism or absolute pluralism, because while maintaining that there are many things, it denies that there is a whole

composed of those things. We shall see, therefore, that philosophical propositions, instead of being concerned with the whole of things collectively, are concerned with all things distributively; and not only must they be concerned with all things, but they must be concerned with such properties of all things as do not depend upon the accidental nature of the things that there happen to be, but are true of any possible world, independently of such facts as can only be discovered by our senses.

This brings us to a second characteristic of philosophical propositions, namely that they must be *a priori*. A philosophical proposition must be such as can be neither proved nor disproved by empirical evidence. Too often we find in philosophical books arguments based upon the course of history, or the convolutions of the brain, or the eyes of shell-fish. Such special and accidental facts are irrelevant to philosophy, which must make only such assertions as would be equally true however the actual world were constituted.

We may sum up these two characteristics of philosophical propositions by saying that *philosophy is the science of the possible.* But this statement unexplained is liable to be misleading, since it may be thought that the possible is something other than the general, whereas in fact the two are indistinguishable.

Philosophy, if what has been said is correct, becomes indistinguishable from logic as that word has now come to be used. The study of logic consists, broadly speaking, of two not very sharply distinguished portions. On the one hand it is concerned with those general statements which can be made concerning everything without mentioning any one thing or predicate or relation, such for example as 'if x is a member of the class α and every member of α is a member of β, then x is a member of

the class β, whatever x, α, and β may be'. On the other hand, it is concerned with the analysis and enumeration of logical *forms*, i.e. with the kinds of propositions that may occur, with the various types of facts, and with the classification of the constituents of facts. In this way logic provides an inventory of possibilities, a repertory of abstractly tenable hypotheses.

It might be thought that such a study would be too vague and too general to be of any very great importance, and that, if its problems became at any point sufficiently definite, they would be merged in the problems of some special science. It appears, however, that this is not the case. In some problems, for example, the analysis of space and time, the nature of perception, or the theory of judgement, the discovery of the logical form of the facts involved is the hardest part of the work and the part whose performance has been most lacking hitherto. It is chiefly for want of the logical hypothesis that such problems have hitherto been treated in such an unsatisfactory manner, and have given rise to those contradictions or antinomies in which the enemies of reason among philosophers have at all times delighted.

By concentrating attention upon the investigation of logical forms, it becomes possible at last for philosophy to deal with its problems piecemeal, and to obtain, as the sciences do, such partial and probably not wholly correct results as subsequent investigation can utilize even while it supplements and improves them. Most philosophies hitherto have been constructed all in one block, in such a way that, if they were not wholly correct, they were wholly incorrect, and could not be used as a basis for further investigations. It is chiefly owing to this fact that philosophy, unlike science, has hitherto been unprogressive, because each original

philosopher has had to begin the work again from the beginning, without being able to accept anything from the work of his predecessors. A scientific philosophy such as I wish to recommend will be piecemeal and tentative like other sciences; above all, it will be able to invent hypotheses which, even if they are not wholly true, will yet remain fruitful after the necessary corrections have been made. This possibility of successive approximations to the truth is, more than anything else, the source of the triumphs of science, and to transfer this possibility to philosophy is to ensure a progress in method whose importance it would be almost impossible to exaggerate.

The essence of philosophy as thus conceived is analysis, not synthesis. To build up systems of the world, like Heine's German professor who knit together fragments of life and made an intelligible system out of them, is not, I believe, any more feasible than the discovery of the philosopher's stone. What is feasible is the understanding of general forms, and the division of traditional problems into a number of separate and less baffling questions. 'Divide and conquer' is the maxim of success here as elsewhere.

Let us illustrate these somewhat general maxims by examining their application to the philosophy of space, for it is only in application that the meaning or importance of a method can be understood. Suppose we are confronted with the problem of space as presented in Kant's Transcendental Aesthetic, and suppose we wish to discover what are the elements of the problem and what hope there is of obtaining a solution of them. It will soon appear that three entirely distinct problems, belonging to different studies, and requiring different methods for their solution, have been confusedly

combined in the supposed single problem with which Kant is concerned. There is a problem of logic, a problem of physics, and a problem of theory of knowledge. Of these three, the problem of logic can be solved exactly and perfectly; the problem of physics can probably be solved with as great a degree of certainty and as great an approach to exactness as can be hoped in an empirical region; the problem of epistemology, however, remains very obscure and very difficult to deal with. Let us see how these three problems arise.

(1) The logical problem has arisen through the suggestions of non-Euclidean geometry. Given a body of geometrical propositions, it is not difficult to find a minimum statement of the axioms from which this body of propositions can be deduced. It is also not difficult, by dropping or altering some of these axioms, to obtain a more general or a different geometry, having, from the point of view of pure mathematics, the same logical coherency and the same title to respect as the more familiar Euclidean geometry. The Euclidean geometry itself is true perhaps of actual space (though this is doubtful), but certainly of an infinite number of purely arithmetical systems, each of which, from the point of view of abstract logic, has an equal and indefeasible right to be called a Euclidean space. Thus space as an object of logical or mathematical study loses its uniqueness; not only are there many kinds of spaces, but there are an infinity of examples of each kind, though it is difficult to find any kind of which the space of physics may be an example, and it is impossible to find any kind of which the space of physics is certainly an example. As an illustration of one possible logical system of geometry we may consider all relations of three terms which are analogous in certain formal

respects to the relation 'between' as it appears to be in actual space. A space is then defined by means of one such three-term relation. The points of the space are all the terms which have this relation to something or other, and their order in the space in question is determined by this relation. The points of one space are necessarily also points of other spaces, since there are necessarily other three-term relations having those same points for their field. The space in fact is not determined by the class of its points, but by the ordering three-term relation. When enough abstract logical properties of such relations have been enumerated to determine the resulting kind of geometry, say, for example, Euclidean geometry, it becomes unnecessary for the pure geometer in his abstract capacity to distinguish between the various relations which have all these properties. He considers the whole class of such relations, not any single one among them. Thus in studying a given kind of geometry the pure mathematician is studying a certain class of relations defined by means of certain abstract logical properties which take the place of what used to be called axioms. The nature of geometrical *reasoning* therefore is purely deductive and purely logical; if any special epistemological peculiarities are to be found in geometry, it must not be in the reasoning, but in our knowledge concerning the axioms in some given space.

(2) The physical problem of space is both more interesting and more difficult than the logical problem. The physical problem may be stated as follows:—to find in the physical world, or to construct from physical materials, a space of one of the kinds enumerated by the logical treatment of geometry. This problem derives its difficulty from the attempt to accommodate to the

roughness and vagueness of the real world some system possessing the logical clearness and exactitude of pure mathematics. That this can be done with a certain degree of approximation is fairly evident. If I see three people *A*, *B*, and *C* sitting in a row, I become aware of the fact which may be expressed by saying that *B* is between *A* and *C* rather than that *A* is between *B* and *C*, or *C* is between *A* and *B*. This relation of 'between' which is thus perceived to hold has some of the abstract logical properties of those three-term relations which, we saw, give rise to a geometry, but its properties fail to be exact, and are not, as empirically given, amenable to the kind of treatment at which geometry aims. In abstract geometry we deal with points, straight lines, and planes; but the three people *A*, *B*, and *C* whom I see sitting in a row are not exactly points, nor is the row exactly a straight line. Nevertheless physics, which formally assumes a space containing points, straight lines, and planes, is found empirically to give results applicable to the sensible world. It must therefore be possible to find an interpretation of the points, straight lines, and planes of physics in terms of physical data, or at any rate in terms of data together with such hypothetical additions as seem least open to question. Since all data suffer from a lack of mathematical precision through being of a certain size and somewhat vague in outline, it is plain that if such a notion as that of a point is to find any application to empirical material, the point must be neither a datum nor a hypothetical addition to data, but a *construction* by means of data with their hypothetical additions. It is obvious that any hypothetical filling out of data is less dubious and unsatisfactory when the additions are closely analogous to data than when they are of a radically different sort. To

assume, for example, that objects which we see continue, after we have turned away our eyes, to be more or less analogous to what they were while we were looking, is a less violent assumption than to assume that such objects are composed of an infinite number of mathematical points. Hence in the physical study of the geometry of physical space, points must not be assumed *ab initio* as they are in the logical treatment of geometry, but must be constructed as systems composed of data and hypothetical analogues of data. We are thus led naturally to define a physical point as a certain class of those objects which are the ultimate constituents of the physical world. It will be the class of all those objects which, as one would naturally say, *contain* the points. To secure a definition giving this result, without previously assuming that physical objects are composed of points, is an agreeable problem in mathematical logic. The solution of this problem and the perception of its importance are due to my friend Dr. Whitehead. The oddity of regarding a point as a class of physical entities wears off with familiarity, and ought in any case not to be felt by those who maintain, as practically every one does, that points are mathematical fictions. The word 'fiction' is used glibly in such connexions by many men who seem not to feel the necessity of explaining how it can come about that a fiction can be so useful in the study of the actual world as the points of mathematical physics have been found to be. By our definition, which regards a point as a class of physical objects, it is explained both how the use of points can lead to important physical results, and how we can nevertheless avoid the assumption that points are themselves entities in the physical world.

Many of the mathematically convenient properties of abstract logical spaces cannot be either known to belong

or known not to belong to the space of physics. Such are all the properties connected with continuity. For to know that actual space has these properties would require an infinite exactness of sense-perception. If actual space is continuous, there are nevertheless many possible non-continuous spaces which will be empirically indistinguishable from it; and, conversely, actual space may be non-continuous and yet empirically indistinguishable from a possible continuous space. Continuity, therefore, though obtainable in the *a priori* region of arithmetic, is not with certainty obtainable in the space or time of the physical world: whether these are continuous or not would seem to be a question not only unanswered but for ever unanswerable. From the point of view of philosophy, however, the discovery that a question is unanswerable is as complete an answer as any that could possibly be obtained. And from the point of view of physics, where no empirical means of distinction can be found, there can be no empirical objection to the mathematically simplest assumption, which is that of continuity.

The subject of the physical theory of space is a very large one, hitherto little explored. It is associated with a similar theory of time, and both have been forced upon the attention of philosophically minded physicists by the discussions which have raged concerning the theory of relativity.

(3) The problem with which Kant is concerned in the Transcendental Aesthetic is primarily the epistemological problem: 'How do we come to have knowledge of geometry *a priori*?' By the distinction between the logical and physical problems of geometry, the bearing and scope of this question are greatly altered. Our knowledge of pure geometry is *a priori* but is purely

logical. Our knowledge of physical geometry is synthetic, but is not *a priori*. Our knowledge of pure geometry is hypothetical, and does not enable us to assert, for example, that the axiom of parallels is true in the physical world. Our knowledge of physical geometry, while it does enable us to assert that this axiom is approximately verified, does not, owing to the inevitable inexactitude of observation, enable us to assert that it is verified *exactly*. Thus, with the separation which we have made between pure geometry and the geometry of physics, the Kantian problem collapses. To the question, 'How is synthetic *a priori* knowledge possible?' we can now reply, 'It is not possible,' at any rate if 'synthetic' means 'not deducible from logic alone'. Our knowledge of geometry, like the rest of our knowledge, is derived partly from logic, partly from sense, and the peculiar position which in Kant's day geometry appeared to occupy is seen now to be a delusion. There are still some philosophers, it is true, who maintain that our knowledge that the axiom of parallels, for example, is true of actual space, is not to be accounted for empirically, but is as Kant maintained derived from an *a priori* intuition. This position is not logically refutable, but I think it loses all plausibility as soon as we realize how complicated and derivative is the notion of physical space. As we have seen, the application of geometry to the physical world in no way demands that there should really be points and straight lines among physical entities. The principle of economy, therefore, demands that we should abstain from assuming the existence of points and straight lines. As soon, however, as we accept the view that points and straight lines are complicated constructions by means of classes of physical entities, the hypothesis that we have an

a priori intuition enabling us to know what happens to straight lines when they are produced indefinitely becomes extremely strained and harsh; nor do I think that such an hypothesis would ever have arisen in the mind of a philosopher who had grasped the nature of physical space. Kant, under the influence of Newton, adopted, though with some vacillation, the hypothesis of absolute space, and this hypothesis, though logically unobjectionable, is removed by Occam's razor, since absolute space is an unnecessary entity in the explanation of the physical world. Although, therefore, we cannot refute the Kantian theory of an *a priori* intuition, we can remove its grounds one by one through an analysis of the problem. Thus here, as in many other philosophical questions, the analytic method, while not capable of arriving at a demonstrative result, is nevertheless capable of showing that all the positive grounds in favour of a certain theory are fallacious and that a less unnatural theory is capable of accounting for the facts.

Another question by which the capacity of the analytic method can be shown is the question of realism. Both those who advocate and those who combat realism seem to me to be far from clear as to the nature of the problem which they are discussing. If we ask: 'Are our objects of perception *real* and are they *independent* of the percipient?' it must be supposed that we attach some meaning to the words 'real' and 'independent', and yet, if either side in the controversy of realism is asked to define these two words, their answer is pretty sure to embody confusions such as logical analysis will reveal.

Let us begin with the word 'real'. There certainly are objects of perception, and therefore, if the question whether these objects are real is to be a substantial

question, there must be in the world too sorts of objects, namely, the real and the unreal, and yet the unreal is supposed to be essentially what there is not. The question what properties must belong to an object in order to make it real is one to which an adequate answer is seldom if ever forthcoming. There is of course the Hegelian answer, that the real is the self-consistent and that nothing is self-consistent except the Whole, but this answer, true or false, is not relevant in our present discussion, which moves on a lower plane and is concerned with the status of objects of perception among other objects of equal fragmentariness. Objects of perception are contrasted, in the discussions concerning realism, rather with psychical states on the one hand and matter on the other hand than with the all-inclusive whole of things. The question we have therefore to consider is the question as to what can be meant by assigning 'reality' to some but not all of the entities that make up the world. Two elements, I think, make up what is felt rather than thought when the word 'reality' is used in this sense. A thing is real if it persists at times when it is not perceived; or again, a thing is real when it is correlated with other things in a way which experience has led us to expect. It will be seen that reality in either of these senses is by no means necessary to a thing, and that in fact there might be a whole world in which nothing was real in either of these senses. It might turn out that the objects of perception failed of reality in one or both of these respects, without its being in any way deducible that they are not parts of the external world with which physics deals. Similar remarks will apply to the word 'independent'. Most of the associations of this word are bound up with ideas as to causation which it is not now possible to

maintain. A is independent of B when B is not an indispensable part of the *cause* of A. But when it is recognized that causation is nothing more than correlation, and that there are correlations of simultaneity as well as of succession, it becomes evident that there is no uniqueness in a series of causal antecedents of a given event, but that, at any point where there is a correlation of simultaneity, we can pass from one line of antecedents to another in order to obtain a new series of causal antecedents. It will be necessary to specify the causal law according to which the antecedents are to be considered. I received a letter the other day from a correspondent who had been puzzled by various philosophical questions. After enumerating them he says: 'These questions led me from Bonn to Strassburg, where I found Professor Simmel.' Now, it would be absurd to deny that these questions caused his body to move from Bonn to Strassburg, and yet it must be supposed that a set of purely mechanical antecedents could also be found which would account for this transfer of matter from one place to another. Owing to this plurality of causal series antecedent to a given event, the notion of *the* cause becomes indefinite, and the question of independence becomes correspondingly ambiguous. Thus, instead of asking simply whether A is independent of B, we ought to ask whether there is a series determined by such and such causal laws leading from B to A. This point is important in connexion with the particular question of objects of perception. It may be that no objects quite like those which we perceive ever exist unperceived; in this case there will be a causal law according to which objects of perception are not independent of being perceived. But even if this be the case, it may nevertheless also happen

that there are purely physical causal laws determining the occurrence of objects which are perceived by means of other objects which perhaps are not perceived. In that case, in regard to such causal laws objects of perception will be independent of being perceived. Thus the question whether objects of perception are independent of being perceived is, as it stands, indeterminate, and the answer will be yes or no according to the method adopted of making it determinate. I believe that this confusion has borne a very large part in prolonging the controversies on this subject, which might well have seemed capable of remaining for ever undecided. The view which I should wish to advocate is that objects of perception do not persist unchanged at times when they are not perceived, although probably objects more or less resembling them do exist at such times; that objects of perception are part, and the only empirically knowable part, of the actual subject-matter of physics, and are themselves properly to be called physical; that purely physical laws exist determining the character and duration of objects of perception without any reference to the fact that they are perceived; and that in the establishment of such laws the propositions of physics do not presuppose any propositions of psychology or even the existence of mind. I do not know whether realists would recognize such a view as realism. All that I should claim for it is, that it avoids difficulties which seem to me to beset both realism and idealism as hitherto advocated, and that it avoids the appeal which they have made to ideas which logical analysis shows to be ambiguous. A further defence and elaboration of the positions which I advocate, but for which time is lacking now, will be found indicated in my book on *Our Knowledge of the External World*.[1]

[1] Open Court Company, 1914.

The adoption of scientific method in philosophy, if I am not mistaken, compels us to abandon the hope of solving many of the more ambitious and humanly interesting problems of traditional philosophy. Some of these it relegates, though with little expectation of a successful solution, to special sciences, others it shows to be such as our capacities are essentially incapable of solving. But there remain a large number of the recognized problems of philosophy in regard to which the method advocated gives all those advantages of division into distinct questions, of tentative, partial, and progressive advance, and of appeal to principles with which, independently of temperament, all competent students must agree. The failure of philosophy hitherto has been due in the main to haste and ambition: patience and modesty, here as in other sciences, will open the road to solid and durable progress.